Electrical Review

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Equipment of Army Supply Base at Philadelphia

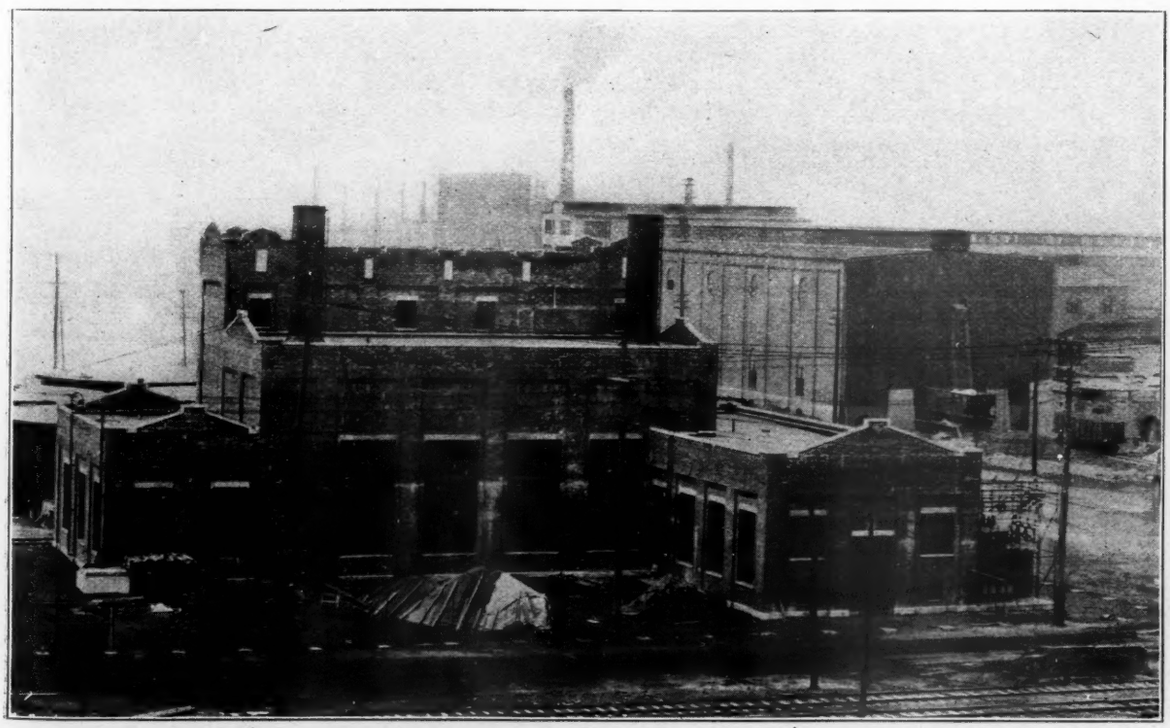
Description of Piers and Warehouses to Be Used as Loading Station for U. S. Army—Power House and Substation for Incoming Central-Station Service Lines—Electrical Equipment at Base

So many were the undertakings during the recent war, initiated in order to utilize facilities to the best advantage, that even at this time we still hear of things accomplished. There were many determining factors in these accomplishments and not the least was the part which electricity played. Central-station companies were ever ready to supply energy for constructing and operating purposes, and without them war work would have been sadly hampered.

A notable example of such a central-station company was the Philadelphia Electric Co. Within the territory served directly or indirectly from the system of this company, approximately 90% of the industries were engaged in the fulfillment of war orders. This high percentage was largely due to the fact that the aggregate of shipbuilding capacity within this area well exceeds that of any similar area in other locations in the United States.

Base Built for Loading Supplies and Equipment for Army.

Of the many projects undertaken in this vicinity, a rather important one was the Army Supply Base at Philadelphia, authorized by the United States Government in August, 1919. Planned for the loading of overseas ships with supplies and equipment for the American Expeditionary Forces, this base is located at Greenwich Point, near the great shipbuilding yards on the Delaware river, in a position which offers suitable dock and warehouse facilities. With piers respectively 1500 ft. and 1320 ft. in length, the warehouse capacity at the Philadelphia base is 145,000 tons of cargo, or the equivalent of 7300



General View of Power House and of Substation for Incoming Lines of Philadelphia Electric Co. at Philadelphia Army Supply Base.

View of Piers, Warehouses and Power House of Philadelphia Army Supply Base, Located at Greenwich Point, Near the

loaded box cars, assuming average loading of 40,000 lbs. for each car. These 7300 cars would make up a freight train over 55 miles long.

Main features of the work are two immense piers, known as pier "B" and pier "C," extending into the Delaware river, pier "C" being slightly shorter than pier "B." It was originally planned to place twin, three-story, reinforced concrete warehouse structures on each of these piers, but with the signing of the armistice it was decided to omit the warehouse superstructure on pier "C" and to construct the pier for open deck service instead. The two warehouses on pier "B" are each 1500 ft. long. There can be placed on the warehouse sidings of pier "B" 104 cars at one time.

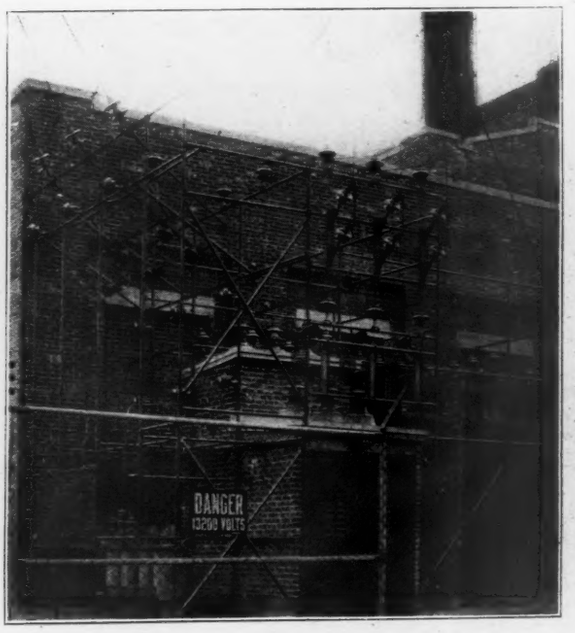
Other prominent features in connection with this supply base are a loading pier, marginal wharves, dockage slips with a low-tide depth of 35 ft. for the accommodation of large ocean-going vessels and extensive railroad and cargo-handling facilities. A steam boiler plant and an electrical substation are provided to furnish power for the operations involved in conducting the base.

Electrically equipped throughout, this base was to be a model of efficiency and effectiveness. Cranes, winches, hoists, elevators, freight tractors and other mechanical accessories electrically operated were to be installed in order to facilitate the movement of supplies to and from as well as within the base.

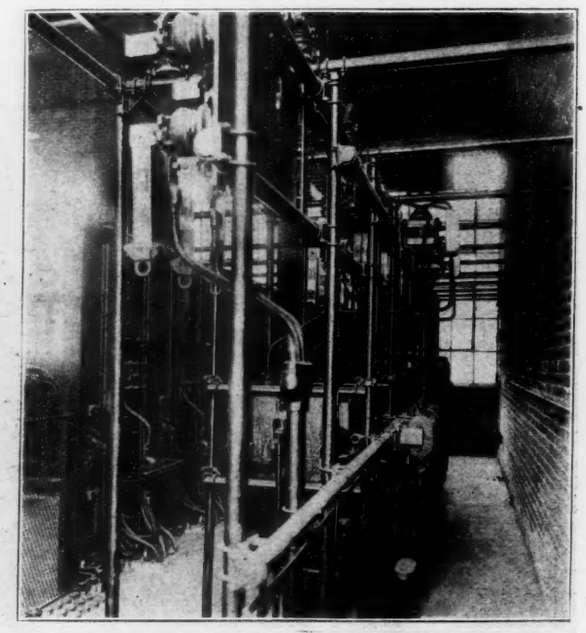
Central-Station Service Used for Power and Light.

According to the plans, now being carried through to completion, the incoming 13,200-volt, 60-cycle circuit from the Philadelphia Electric Co. passes through a 300-ampere oil switch to a bank of three 400-kv-a. power transformers which step the voltage down to 2300. Lightning protection is afforded by a set of electrolytic lightning arresters on the incoming 13,200-volt line.

From the outdoor transformers the 2300-volt secondary circuit is carried into an indoor substation, from which the energy is distributed at various voltages to the service centers on the piers and in the warehouses. The incoming 2300-volt line is connected to a 13-panel distribution switchboard. Two sets of leads from this board pass to two 24-kv-a. constant-current



Outdoor Substation, Showing Incoming Lines of Philadelphia Electric Co.



View Behind the A-C Switchboard in Power House of Army Base.

Great Shipbuilding Yards on the Delaware River—Base for Loading Supplies and Equipment for United States Army.

regulators. Another set supplies service to a bank of three 37.5-kv-a. transformers, which step the voltage down to 110 and 220 for the lighting systems and the low-voltage apparatus.

Also, a set of 2300-volt feeders passes from the switchboard to a series of small transformer sets located in the pent houses at the elevator shafts in the main warehouse on one of the piers. Each of these sets contain three transformers, two being of 25-kv-a. capacity and the third of 20-kv-a. Those of 25-kv-a. capacity are used for supplying energy at 440 volts to the elevators. The 20-kv-a. unit supplies energy at 220 and 110 volts for lighting.

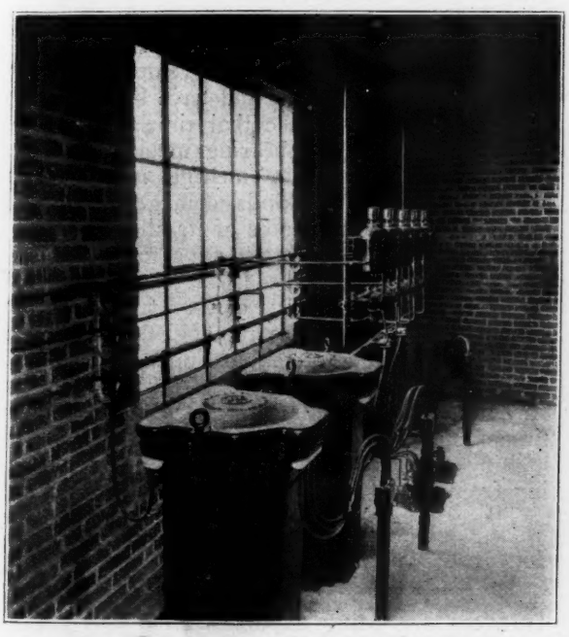
Direct Current Supplied to Cranes Through Rotary Converters.

It is noteworthy that the motors on the various cranes and hoisting machinery are designed to conform to the standards adopted with similar apparatus operated in connection with the United States cargo-handling centers in Europe. These motors require d-c. energy at a voltage of 600. To provide this energy, the main substation is equipped with two 500-kw. rotary converters connected to the a-c. circuit through a 500-kv-a., three-phase transformer. A four-panel switchboard is used for the control and distribution of the direct current. The rotary converters, with their transformers and the two main switchboards, are of Westinghouse make. Space has been provided in the substation for the ultimate installation, if necessary, of a third rotary with its transformer and switching equipment.

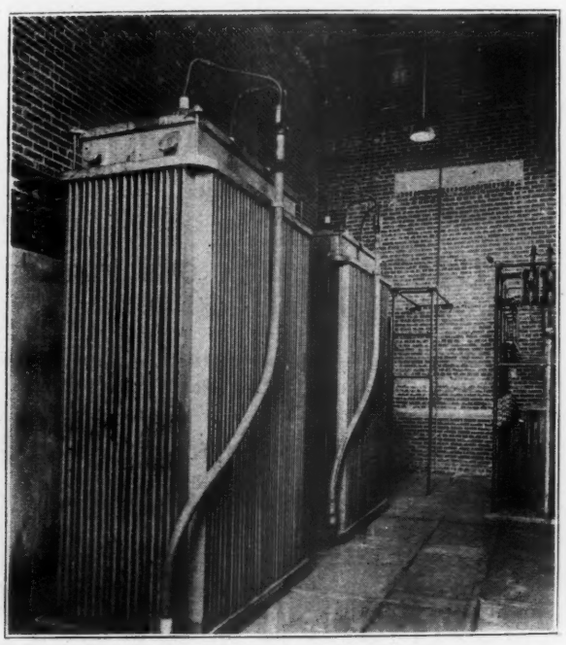
Electric Trucks Are Used for Moving the Freight.

For the shifting of freight about the floors of the main warehouse and other areas, where feasible, electric tractors will be used. To charge the batteries on these tractors, four 20-kw. motor-generators will be available, the charging station being located on one of the piers. The motors are of the induction type and take 2300-volt three-phase current. The d-c. generators are of the three-wire type and supply energy at voltages of 40 to 80. The control apparatus for these sets is comprised in a four-panel a-c. motor-control switchboard and an eight-panel d-c. switchboard for the distribution of the current to the charging circuits.

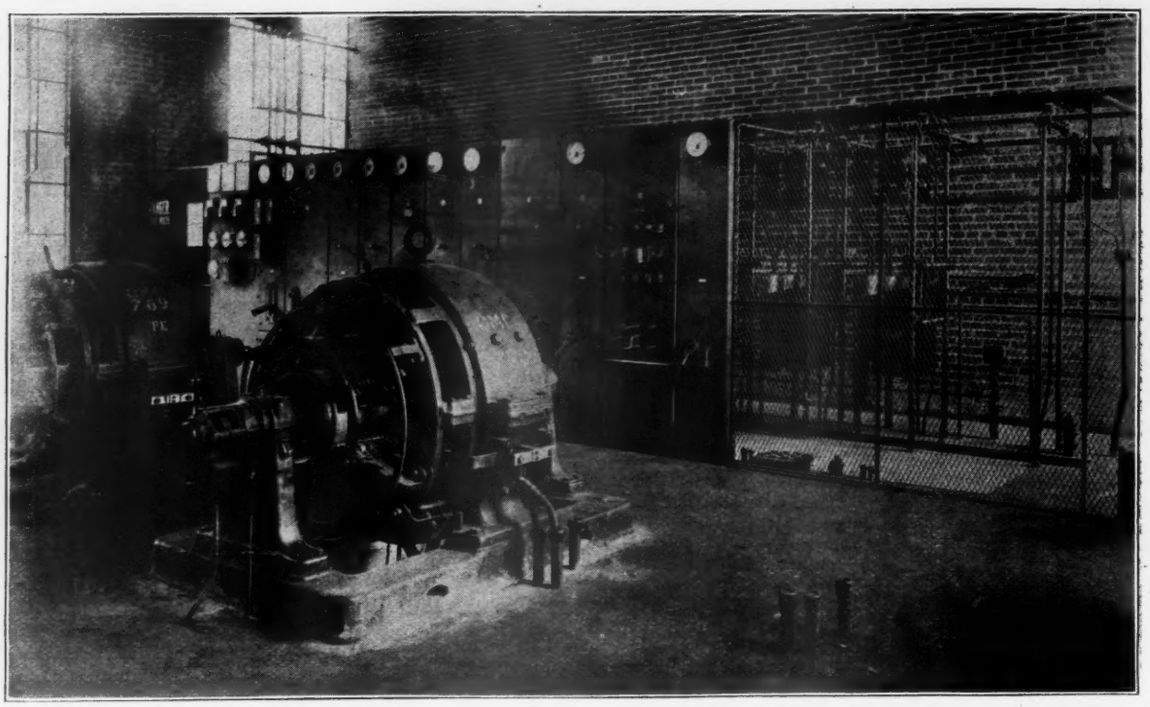
The elevators will be of A. B. See Co. manu-



Transformer Equipment on One of the Piers for Supplying Power for Elevators and for Lighting.



Transformer Room in Substation Power House of Philadelphia Army Supply Base.



Interior of Power House, Showing Switchboard and Rotary Converters for Supplying Direct Current to Crane Motors.

facture and will be driven by means of 400-volt a-c. motors.

The governmental organization in charge of the work consists of a commissioned staff of officers and a governmental civilian corps of auditors, timekeepers, assistants and clerks. The officer having general charge is Lieut.-Col. E. B. Morden, U. S. A., the constructing quartermaster at Philadelphia.

These furnaces range in power capacity from 40 to 500 kw. and are being used in a great variety of industries. The use of melting furnaces is not confined to any one locality, in fact, furnaces are being exported from the United States to Japan, Mexico, Canada and other countries.

All engineering matters in the field, including design, layout, supervision and inspection of the work and planning, are under the jurisdiction of the supervising engineers, Day & Zimmermann, Inc., of Philadelphia and New York.

The construction work is being carried through by the Snare & Triest Co., of New York, the general contractors.

MELTING OF NONFERROUS METALS IN ELECTRIC FURNACES.

Rapid Progress Is Made in the Application of Electrical Furnaces During Past Two Years, Especially for Melting Operations.

The use of the electric furnace for melting nonferrous metals and alloys has increased more rapidly than has been commonly appreciated during the last two years.

According to the data available there are at present in the United States no fewer than 261 electric furnaces of various types operating or contracted for which are devoted to the brass, copper, zinc, aluminum or nonferrous alloy industries. The comparison with the similar progress in the electric steel industry is very striking, for from 1913 to 1918 inclusive electric furnaces operating in the steel industry increased from 19 to 233, the total in five years, thus being less than was reached in the nonferrous industry in two years.

Comparisons are only possible, however, in a numerical way, for operating conditions are essentially different in the two industries. In the steel industry the function of the electric furnace is in most cases a refining one, whereas in the nonferrous industry the furnace is used for melting only. In the early trials much difficulty was found in melting yellow brasses, because of the heavy loss of zinc due to high temperatures. That this has been overcome is evidenced by the fact that at least 170 of the 261 furnaces are now devoted to the yellow brass industry.

Electrical furnaces were developed for the melting of silver in 1914 and have been used in increasing numbers since that time. From the melting of silver and bearing metal alloys the use of electricity as a melting medium has spread to brass of all kinds, coinage metals and alloys, aluminum and some of its alloys and into other fields. The constant appearance of new nonferrous alloys, some involving the use of the rarer metals, the new uses for the more common alloys and metals and the unlimited possibilities for new combinations, point to the further development of uses for the electric furnace in the immediate future. At the present time one manufacturer supplies furnaces, for the melting of nonferrous metals, in capacities ranging from 1.5 to 24 tons per day.

These furnaces range in power capacity from 40 to 500 kw. and are being used in a great variety of industries. The use of melting furnaces is not confined to any one locality; in fact, furnaces are being exported from the United States to Japan, Mexico, Canada and other countries.

Steel Transmission Line Towers

Spacing of Conductors and Clearance Above Ground—Specifications for the Design of Towers, with Data on Factors of Safety and Unit Stresses—Effect of Loading on Design of Different Types of Towers

By E. L. GEMMILL

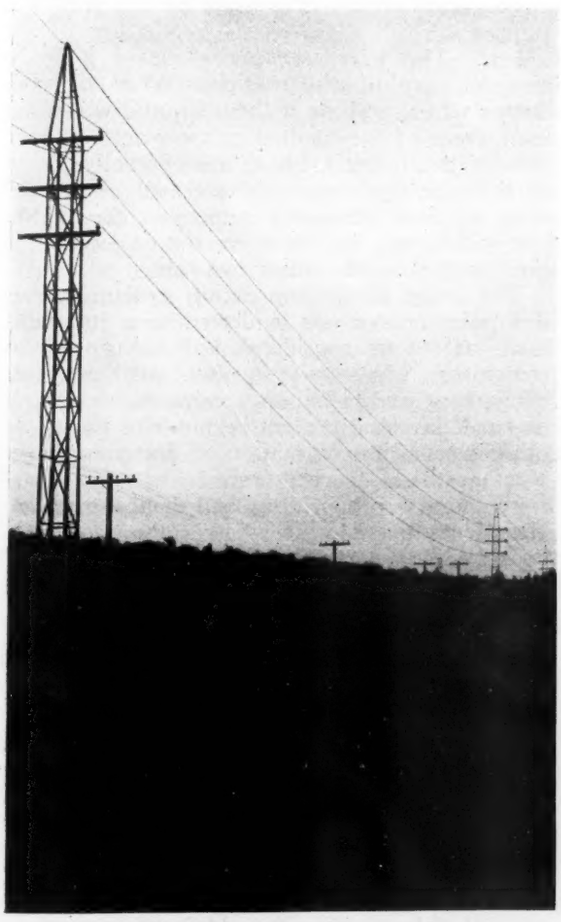
Chief Engineer, Transmission Tower Department, Blaw-Knox Co., Pittsburgh.

This is the fourth of a series of articles by Mr. Gemmill on the subject of steel supports for transmission lines, the preceding articles dealing with modern engineering practice in connection with loading and wind pressure on transmission towers and lines, theory of suspended wires, and a discussion of the relations existing between stress, temperature and sag in transmission lines. The concluding article, which will appear in an early issue, will give a review of latest practice in the design of straight-line, anchor and dead-end towers, the design of anchorages and the spacing and erection of towers.—EDITOR'S NOTE.

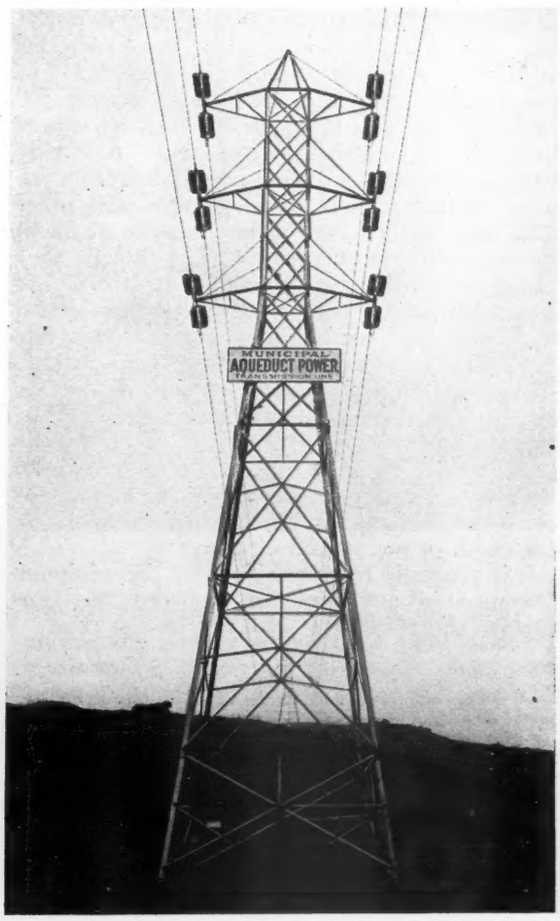
The problem of determining the type and the spacing of the towers to be used is one that requires considerable study. The towers are only a part of the complete installation of a transmission line, and a saving on one item may easily be more than offset by an increased cost of some other items affected by the same conditions which made the initial saving. In other words, it is a case of balancing one condition against another to determine the best possible combination. The supporting structures must, of course, be placed as far apart as possible, but an analysis of the various sag conditions makes it evident that there are definite limits to be observed.

SPACING OF CONDUCTORS.

After the spacing of towers has been determined, together with the size of wires to be used and the voltage to be carried by them, the next consideration is the spacing of the several wires and the minimum clearance from the ground line to the lowest wire under the worst loading condition. The maximum sag to be allowed must then be determined, and this condition, along with the assumed loading across the line, will determine the pull which may occur in the direction of the line on the wire. The spac-



Steel Poles for Stringing Two 6600-Volt Lines.



Strain Tower for Double-Circuit 110,000-Volt Line.

ing of the wires in both horizontal and vertical directions is dependent upon the voltage carried and upon the length of spans. The minimum spacing, especially in the horizontal direction, will obtain when the wires are supported on pin insulators or are attached to the crossarms by means of strain insulators. For this condition it is recommended that, for conductors carrying alternating current, the minimum separation of these conductors, at the points of support shall be 1 in. for every 20 ft. of span, and 1 in. additional for each foot of normal sag, but in no case shall the separation be less than:

Line Voltage	*Clearance*
6,600 volts and less	14.5 ins.
6,600—14,000 volts	24.0 ins.
14,000—27,000 volts	30.0 ins.
27,000—35,000 volts	36.0 ins.
35,000—47,000 volts	45.0 ins.
47,000—70,000 volts	60.0 ins.

For voltages higher than 70,000 the minimum separation should be 60 ins. plus 0.6 in. for every additional 1000 volts.

When conductors are supported by suspension insulators, the separation of them horizontally must be made greater than when they are supported on pin-type insulators. The amount of this increase is empirical, and is more or less a matter of judgment on the part of the engineer who designs the line. When the conductor wire is supported from the crossarm by strain insulators, it is frequently assumed that the jumper wire will swing to a position making an angle of 30 deg. with the vertical. It is usually assumed that the maximum swing of a suspension insulator string will be to an angle of 45 deg., but this depends upon the size and weight of the conductor and also upon the assumed maximum loading. It is possible that under unusually severe conditions two wires suspended from the same crossarm may swing toward each other until each of them will make an angle of about 30 deg. with the vertical. Even though they do not both swing the same amount, it is a safe assumption that twice the horizontal projection of the length of one insulator string when swung to 30 deg. from the vertical will be equivalent to the sum of the horizontal projections of the two wires when swinging toward each other under the worst conditions of service. This means that when wires are supported by suspension insulators instead of on pin-type insulators the horizontal separation should be increased by the length of one insulator string.

It is generally recommended that the minimum clearance in any direction between the conductors and the tower shall not be less than:

Line Voltage	*Clearance*
14,000 volts or less	9 ins.
14,000—27,000 volts	15 ins.
27,000—35,000 volts	18 ins.
35,000—47,000 volts	21 ins.
47,000—70,000 volts	24 ins.

Usually the suspension insulators are made sufficiently long so that when swung out to the assumed position of maximum swing the vertical distance between the conductor and its supporting crossarm, or any other part of the tower, will meet all the requirements for clearance. The overhead ground wire or wires should be, in general, not more than 45 deg. from the vertical through the adjoining conductor.

The several wires must be spaced far enough apart vertically so that under the worst conditions the wires will not come so close together as to make trouble electrically. This must have careful consideration, especially on the very long spans, because it is entirely possible during storms for the lowest wires to be free from ice loading or to be suddenly relieved of such loading, when they might swing up, close to the wires directly above them, which might be heavily loaded with ice and hence have considerable sag.

The arrangement and spacing of the wires almost always fixes, within certain limits, the general type of the supporting structure to be used. This is at least true of the upper part of it. The outline of the structure below the lowest crossarm will be made that which is the most economical, unless such an outline is prohibitive on account of right-of-way or other limiting conditions.

Where the transmission line consists of three conductor wires, with or without a ground wire, it very often works out to very good advantage to put the three conductor wires in the same horizontal plane, which means that the middle one will pass through the tower. When suspension insulators are used with this arrangement of wires, the tower must be made wide enough to allow ample clearance from the conductor when swung to maximum position either way. But if strain insulators are used, then a much narrower tower may be used by attaching the jumper wire to a pin on the center line of the tower. The narrower tower makes a much more economical construction. When six conductor wires, with or without ground wires, are used, three of the conductors are placed on each side of the tower. These are generally placed so that the three wires in each set are in the same vertical plane, but sometimes the middle one will be put farther from the center line of the tower than the other two wires.

The design of the supporting structures from this point on consists in determining just what loads are to be considered as coming on the structures, what unit stresses shall be used throughout and whether a comparatively large or small investment shall be put into them. In other words, it is a matter of first importance whether these structures are to be regarded as a temporary proposition, and hence made as cheaply as possible, or whether they are to be considered as part of a permanent construction and therefore figured a little more liberally.

Temporary and Permanent Structures.

For a temporary proposition the structures are, of course, made as light as possible and are almost always painted. They are rarely galvanized. In such cases the assumed loadings are kept very low and are intended to take care of only normal conditions, on the theory that if some of the structures should be subjected to loadings of unusual intensity resulting from specially severe storms, it will be more economical to replace some of them that might be destroyed than to provide additional strength in all the supports. For the same reason the unit stresses are always run as high as possible.

On the other hand, where permanency of construction is wanted, the design is made more liberal in every way. To start with, the assumed loadings are such as will be expected to take care of more than ordinary conditions of service. They will be made sufficiently high to be in themselves an insurance against possible interruptions of service due to breakdowns caused by storms. Also, the unit stresses will be kept lower and heavier material will be specified. Generally, but not always, such structures will be required to be galvanized instead of painted, so that the structure can remain in service for a longer time.

When the material is required to be galvanized, many specifications will allow web members to be made of material only ⅛ in. thick, but will require a minimum thickness of 3/16 in. or possibly ¼ in. for the main posts. Almost all specifications require a minimum thickness of material of 3/16 in. for all members when painted, but some specify that no material less than ¼ in. thick shall be used when painted, while others demand a minimum thickness of 3/16 in. for all material, regardless of whether it is painted or galvanized.

The history of transmission line structures proves that where permanency of construction is desired they should always be galvanized. At least all parts of the structure in close proximity to the conductor wires should be galvanized, irrespective of what kind of a protective coating is given to the balance of the structure. This is especially true in those cases where high voltages are used.

Specifications for Designs.

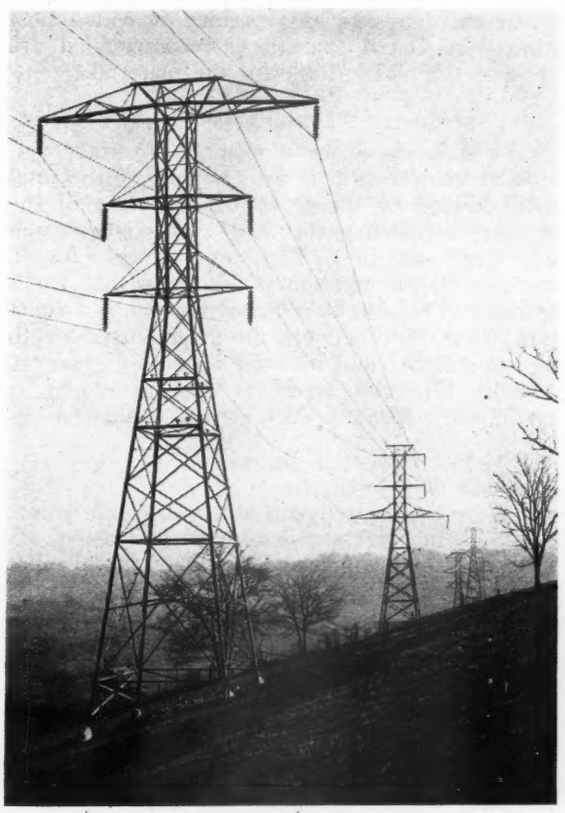
There is no such thing as a standard practice among engineers today regarding the method to be pursued in preparing specifications for transmission line towers on which competitive bids are to be received. Usually for a line requiring several towers the engineer in charge of the installation will determine the arrangement of all the wires, the limiting dimensions for the structures and the loadings for them.

But the design of the structures will be left generally to the manufacturer, subject, however, to those provisions of the specifications which are intended to insure that the towers or poles will all be designed to have the same strength.

Different engineers seek to accomplish this result in as many different ways. Some will specify the loadings under which they expect the towers to be used, and will stipulate that the design shall provide sufficient strength to take care of these loadings with a given factor of safety. Others will state unit stresses which shall be used in determining the sections in the design, to take care of the stresses resulting from the above loadings. Other engineers will increase the desired working loads by some factor which they will introduce as a margin of safety, and will then give these increased loadings instead of the working loadings, and will require that the structures be designed to withstand these loadings without failure. Still other engineers will specify that certain unit stresses shall be used in determining a design, which shall support the specified loadings with a given factor of safety; and, further, that the completed structure must support loads that are twice as large as those specified, but without any restriction regarding unit stresses to be employed.

Factor of Safety.

The term "factor of safety" is in reality a misnomer, and, because of this, it is not always interpreted in the same way by different men. Literally speaking, the structure which is properly designed with a factor of safety of three, should sustain without failure loads three times as great as those which are expected to be the working loads under normal conditions. But the term "factor of safety," as it is usually interpreted and applied, means that the unit stresses used throughout shall be one-third the ultimate strength of the material entering into the construction. In actual practice the results of such an interpretation are very disappointing. In a composite structure made up of a large



Transposition Tower for 130,000-Volt Line.

number of different pieces, some of which are undergoing compression while others are in tension, the action of this body as a whole against outside forces will differ radically from what would be expected of any one of its component parts under a similar test. This, of course, is accentuated in the case of transmission towers, because they are always made as light as possible for the work required of them, and hence, when under load, they deflect considerably from their original outlines, and this in turn produces a rearrangement and entirely different distribution of stresses. The net result of all this is that all such structures will fail when the loading on them reaches the point

where some, if not all, of the members making up the construction are stressed to the elastic limit for their material.

Since the elastic limit for steel in either tension or compression is about one-half its ultimate strength, it follows that the structure whose members are determined by using unit stresses equal to one-third of the ultimate strength of the material will have a total strength only 50% in excess of that required to take care of actual working conditions, so that instead of having the so-called "factor of safety of three" it has an actual factor of safety of one and one-half.

This fact is recognized by those who first multiply the required working loads by a factor which will provide a margin of safety, and then specify that the towers shall support without failure these increased stipulated loads. It is not often that, under these conditions, the specifications will call for the employment of definite unit stresses in determining the several sections of material to be used. But in all such cases when unit stresses are specified it will almost always be found that those recommended are close to the elastic limit for the material.

Unit Stresses.

The unit stress for a member in either tension or compression is the quotient of the total load divided by the cross-sectional area of the member supporting the load. This is given in lbs. per sq. in. The unit stress for a member in compression is less than that for a member in tension by a quantity which is a function of the ratio between the unsupported length of the member and its least radius of gyration. Usually this unit stress is determined by a straight-line formula, such as

$$S_c = S - C\,L/R,$$

in which

S_c = the desired unit stress in compression,

S = the unit stress allowed in tension,

L = the unsupported length of the member in inches.

R = the least radius of gyration for the member, in inches,

C = a constant determined by experimental investigation.

The elastic limit in tension is about 27,000 lbs. per sq. in. of net section. The straight-line formula, $27{,}000 - 90\,L/R$, for unit stresses in compression gives values which have been proven by actual tests to be approximately the elastic limit for the material.

Where the so-called "factor of safety of three" is wanted the unit stress generally specified for members in tension is 18,000 lbs. per sq. in. of net section, while, for unit stress for members in compression, the formula, $18{,}000 - 60\,L/R$, is specified.

It will be noted that these values are just two-thirds of those immediately preceding, and, therefore, offer a margin of safety of 50%. It is not often that unit stresses smaller than these are specified for tower work, but occasionally we find specifications which are very severe, considering the infrequency of maximum or even full loads on this type of structure.

It is common practice among engineers, when specifying that the towers shall safely support certain loads, to refrain from putting any limitations on the design, such as what relationship shall be allowed as a maximum between the length of any compression member and its least radius of gyration. On the other hand, when it is stipulated that the structures shall be figured for carrying certain loads by using given unit stresses, it is almost always also stipulated that the ratio of length of compression members to their least radius of gyration shall be limited to a certain maximum value.

Bolt Values.

Bolts stressed to 24,000 lbs. per sq. in. in shear have values comparable with the strength of members which are figured on the basis of 27,000 lbs. per sq. in. of net section in tension, or $27{,}000 - 90\,L/R$ lbs. per sq. in. of gross section in compression. From this it follows that bolts need not be stressed lower than 16,000 lbs. per sq. in. in shear to get values corresponding to those resulting from using 18,000 lbs. per sq. in. of net section in tension or $18{,}000 - 60\,L/R$ lbs. per sq. in. of gross section in compression for members which are to be connected by means of these bolts. It is evident that smaller values for bolts are unwarranted. Consistent practice in designing requires that the values assumed for bolts shall bear the same ratio to their elastic limit as the ratio obtaining between the working value assumed and the elastic limit for the several members which are connected by the bolts.

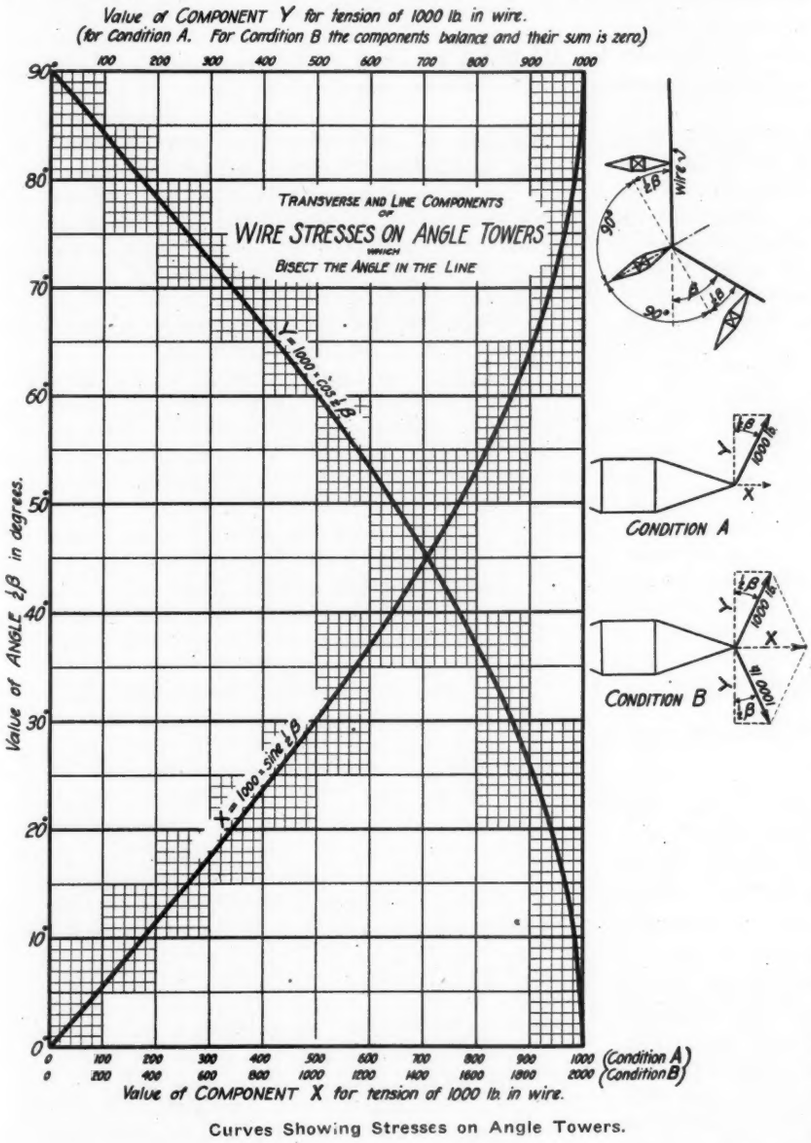
Loadings on Towers.

In regard to the specific loadings for which the structures shall be designed considerable depends upon where they are to be used because there are several factors entering into this question. The first that should be determined is the kind and maximum value of the vertical load to be taken care of at the end of the crossarm. If the line runs through a comparatively level country there is no reason why there should ever be any uplift at the end of the crossarm. But if the line runs along steep grades then there may be times when the vertical load will be upward rather than downward. This is of considerable consequence in the design of the tower. The vertical load at the end of the crossarm is usually supported by members which run from the end of the crossarm to the main post angles at some point above the crossarm. If the vertical load is downward these supporting members will act in tension, but if the load can ever be upward instead of downward, then such members must be capable of taking stress in compression. In cases where the crossarms are long, which is almost always true when suspension insulators are used, these members must be made much heavier to take the stress in compression rather than tension.

Angle Towers.

The next to determine, if possible, is how many towers will have to take care of angles in the line, and what will be the maximum angle encountered. If this angle should be very large

it will be necessary to provide special structures for such points in the line. If the angle is very small provision for it may be made by using one of the straight-line towers at this point and shortening the span on each side of it. This shortening of the span reduces the wind load on the wires transverse to the direction of the line and at the same time reduces the pull in the wires in the direction of the line, if the sag is made a greater percentage of the shortened span than it is in the case of the adjoining spans.


Value of COMPONENT Y for tension of 1000 lb. in wire.
(for Condition A. For Condition B the components balance and their sum is zero)
TRANSVERSE AND LINE COMPONENTS OF WIRE STRESSES ON ANGLE TOWERS WHICH BISECT THE ANGLE IN THE LINE
Y = 1000 × cos ½β
X = 1000 × sine ½β
Value of ANGLE ½β in degrees.
Value of COMPONENT X for tension of 1000 lb. in wire.
(Condition A)
(Condition B)
CONDITION A
CONDITION B
1 WIRE

Curves Showing Stresses on Angle Towers.

The accompanying illustration shows a graphical diagram of the components of the tension in the wire, parallel to the faces of the tower, when its axis parallel to the crossarm bisects the given angle in the line. It will be seen that when the wires leading off in both directions from the end of the crossarm have equal stresses, the component "Y" in one wire balances the corresponding component from the other wire, but that the component "X" is twice what it is when only one wire leads off from the crossarm. This means that in the one case, marked condition "B," the load on the tower is twice the component "X" from one wire, but that for condition "A" the load on the tower is the sum of the components "Y" and "X" from one wire.

It will be noted that for condition "B" the total load on the tower from the pull in the direction of the line will just equal this pull when the tower bisects an angle of 60 deg. in the line, and that this load increases to double the pull on one wire, as a maximum limit, when the angle in the line reaches 180 deg. For condition "A" the total load will always be greater than the pull in the wire, no matter how small the angle in the line, and the worst loading will occur when the tower bisects an angle of 90 deg. in the line. When the angle in the line is as large as 90 deg. it will often be more desirable to construct a special tower and to set it normal to the direction of the line.

Special Towers.

Having determined whether it will be necessary to provide special towers to take care of angles in the line the next step should be to determine how many, if any, special towers should be provided to take care of such special cases as railroad crossings, and what specifications must govern in the design of these special structures. The railroad companies have their own specifications for these structures, and they insist that all wires carried over their crossings shall be supported by structures complying with all their requirements as to loadings and unit stresses to be employed. Their specifications are generally very severe; hence special designs almost always are required for those particular points in the line. Of course, one consideration always to be kept in mind is to make as few different designs as circumstances will allow, so that there will be as much duplication as possible in the structures. This is an especial advantage for economical fabrication of the towers and is also a big advantage when it comes to erecting them in the field.

Every line must be carefully studied and designed for its own particular requirements. A line which is taken through a city must be built in a different way from one going through an open country. The working loads might not need to be any heavier, but either the design loads should be heavier or the unit stresses lower, and the towers should be spaced closer together. As a rule, street crossings and other existing structures have to be considered when spacing towers through a city.

Economy Characteristics of the Steam Turbine

Rules Common to the Performance of Modern Commercial Types of Turbines—Willans Law—Constant Volume Law—Paper Before Technical League of the Milwaukee Electric Railway & Light Co.

By A. C. FLORY

Manager, Steam Turbine Department, Allis-Chalmers Manufacturing Co.

Variations in economy and performance of all types of turbines conform closely to certain simple rules or laws. The fundamental law is that known as "Willans law," which states that the total steam passed per hour by a constant cut-off throttling engine when plotted as a function of the brake hp. of the engine at constant speed will be a straight line. It has been found that this

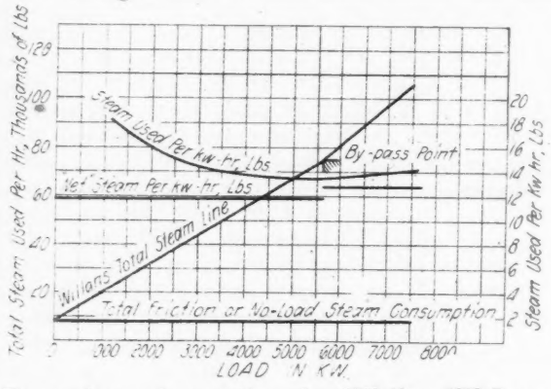

Total Steam Used Per Hr. Thousands of Lbs
Steam Used Per Kw-hr. Lbs
By-pass Point
Net Steam Per Kw-hr. Lbs
Willans Total Steam Line
Total Friction or No-Load Steam Consumption
Steam Used Per Kw-hr. Lbs
LOAD IN KW

Fig. 1.—Steam Consumption of a 5000-Kw., 1800-R.p.m. Turboalternator.

law, which was originally applied to the performance of constant cut-off engines which were regulated by throttling the steam supply, applies also to the performance of all types of steam turbines.

Willans Law.

The Willans total steam line, as shown on Fig. 1, is drawn from data of the estimated steam consumption of a 5000-kw. turboalternator unit. An inspection of the diagram shows that the Willans line extended to zero load indicates that the apparent total steam consumption at no load under the constant operating conditions set forth would be about 8000 lbs. of steam per hr. If this no-load steam consumption is deducted from the total steam for all loads it is obvious that the result would be a constant amount of steam required for each kw-hr. produced up to the by-pass point, where the slope of the line changes. This is indicated on the diagram by a horizontal line marked "Net Steam per Kw-Hr., Lbs." If the no-load steam consumption per hour is divided by the load at any point the quotient can be conventionally termed "Friction Steam per Kw-Hr." The friction steam per kw-hr. added to the net steam per kw-hr. and plotted will produce the familiar curve showing the steam consumption per kw-hr. as a function of the load. This curve is shown on Fig. 1, marked "Steam Used per Kw-Hr., Lbs." It can be seen that the Willans law and its simple derivatives as given on Fig. 1 make a very convenient and relatively simple method of showing graphically the performance of a machine and for checking the accuracy of a series of variable-load, constant-speed tests made under approximately constant conditions.

To illustrate the application of Willans law to the checking of economy tests, the results of a series of tests made under the direction of Prof. C. C. Thomas, of Johns Hopkins University, on a 5000-kw. turboalternator unit installed in Cleveland are plotted as shown in Fig. 2. These tests comprise the official economy tests of the unit mentioned and the data plotted on Fig. 2 are taken from Professor Thomas' report. It is interesting to note how closely the test data conform to the Willans line, indicating the accuracy of the tests.

It is also characteristic of turbine operation that the steam inlet pressure, after the steam has been reduced in pressure by the inlet regulating valve, when plotted as a function of the load, makes a straight line similar in form to the Willans total steam line. The line showing the relation between inlet pressure and load in kw. for the Cleveland unit is plotted from the results of Professor Thomas' tests, shown in Fig. 3. This curve also forms a convenience check upon

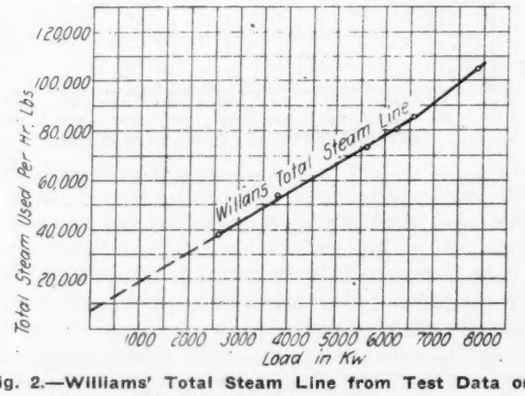


Fig. 2.—Williams' Total Steam Line from Test Data on 5000-Kw. Turboalternator.

the accuracy of a series of tests, provided that the initial steam pressure, quality and vacuum are maintained approximately constant at all the loads at which the tests are made. This characteristic of turbines has another very important application in that it furnishes a convenient

means of checking the internal condition of the turbine while it is in operation. If the line showing the relation between inlet pressure and load in kw. is obtained when the turbine is known to be in good condition and if, subsequently and while the machine is in operation, the inlet pressure and kw. readings are plotted and compared with the original diagram, it is

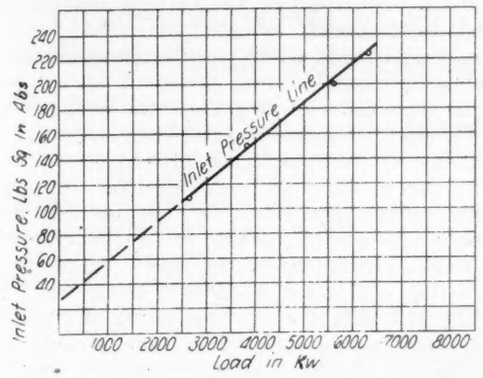


Fig. 3.—Inlet Pressure Data from Test Data on 5000-Kw. Turboalternator.

obvious that any change in the condition of the turbine will be revealed by a change in position or slope (or both) of the line. It is to be hoped that some such procedure will come into general use, since its simplicity would not burden an operating engineer and because it has been found that in many plants there is a progressive accumulation of dirt or scale in turbine blading which ordinarily is not brought to the attention of the station operators until a large decrease in the load-carrying capacity of the unit results or until there is a serious accident to the machine.

Constant Volume Law.

Another characteristic which is common to steam machines which regulate by throttling the pressure of all the steam admitted to the turbine cylinder is known as the constant volume law, as it is based on the fact that, with such regulation, the cu. ft. of steam per hr. entering the turbine nozzle or inlet blading is approximately constant for all loads and initial steam conditions. The constant volume law is illustrated by Fig. 4, on which is plotted data from Professor Thomas' Cleveland tests showing the relation between the Willans total steam line, the specific volume line and the constant volume line. The specific volume line represents the volume, in cu. ft. per lb., of steam at the test inlet pressure and quality (moisture or superheat). The constant volume line is obtained from the products of the total steam per hr. as taken from the Willans line and the calculated specific volume at the different loads as covered by the tests.

The constant volume law has an important application in turbine work, as it furnishes a means for estimating the effect of changes in the initial steam conditions on the weight of steam that the turbine will pass per hr. at constant speed. As an example, if it is known that a certain turbine will pass, without the by-pass being open, 58,000 lbs. of steam per hr. with a pressure of 150 lbs. gauge and dry saturated steam, the total volume of steam passed per hr. at the turbine inlet will be 58,000 lbs. times 2.75 cu. ft. per lb., which equals 159,500 cu. ft. If the steam conditions are changed to 225 lbs. gauge and 125 deg. F. superheat, the weight of steam per hr. which the machine will then pass without the by-pass being open will be in inverse proportion to the ratio of the specific volumes of the steam at the two conditions, since the constant volume law states that the total volume passed per hour at blading inlet is constant. The specific volume of steam at 225 lbs. gauge and 125 deg. superheat being 2.335 cu. ft. per lb., the turbine would then pass 58,000 lbs. times the ratio of 2.75 to 2.335, which equals 68,300 lbs. per hr., the by-pass not being open. The example just given is conventional, as precisely the same machine would not be used for such a wide variation in initial steam conditions, but the principal can be applied with accuracy in practice to smaller variations in steam conditions, and by combination with a knowledge of the effect of steam pressure and superheat on the economy of any particular turbine forms a simple and convenient method of estimating the effect of changes in steam pressure and superheat on the maximum load that can be carried before the by-pass opens.

With constant steam pressure, superheat and vacuum the energy available for work per lb. of steam is constant and it is apparent, in view of Willans Law, that if the total B.t.u. available per hr. were plotted as a function of the load there will result a straight line, as shown in Fig. 5; in this discussion the performance of the machine is as usual, being considered on a Rankine cycle basis. This diagram is plotted from an estimate for a 5000-kw. turbine. The characteristic form of the "Total B.t.u. Available per Hr." line serves to form an additional convenient check on the accuracy of any series of variable-load, constant-speed tests below the by-pass point, and the "No-load or Friction B.t.u." and the "Net B.t.u. Available per Kw-Hr.," which are derived from such plotted data and which are shown in Fig. 5 are of value in turbine economy estimates.

The value of the net B.t.u. available per brake hp-hr. (considering the turbine alone) has been found to be dependent only on the proportion of

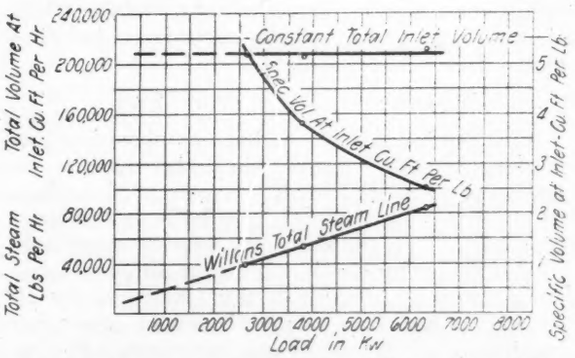


Fig. 4.—Constant Volume Line from Test Data on 5000-Kw. Turboalternator.

the blading of turbines which conform to a general design for a line of machines of various sizes (within certain limits) and for different operating conditions. This value, therefore, is practically constant for different steam pressures, superheats, exhaust pressures and fractional loads. The values of the no-load or friction

TURBOALTERNATOR ECONOMY ESTIMATE.

Fractional load.	Gen output, kw.	Gen. eff.	Brake hp. of turbine.	net B.t.u. per brake per hr.	Total Net B.t.u. hp-hr.	No-load or friction B.t.u. per hr.	Total B.t.u. per hr.	B.t.u. per lb. of steam.	Total steam per hr., lbs.	Steam per kw-hr., lbs.
½	500	.90	745	3300	2,460,000	800,000	3,260,000	323.6	10,075	20.13
¾	750	.926	1085	3300	3,580,000	800,000	4,380,000	323.6	13,530	18.04
1	1000	.941	1423	3300	4,700,000	800,000	5,500,000	323.6	17,000	17.00

B.t.u. available, in the case of a similar line of turbines, are dependent on the sizes of the machines only (excepting large changes in the exhaust pressure) and for a certain size this value is, therefore, also constant for different operating conditions. With data from which a set of values for these two factors can be derived for a line of turbines, the estimating of the steam

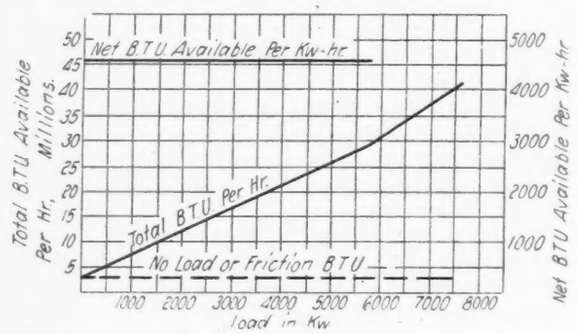


Fig. 5.—Available B.t.u. in Relation to Kw. Load on 5000-Kw. Turboalternator.

consumption of a machine at different loads and for specified operating conditions can be done simply, as in the following example.

It is desired to estimate the steam consumption, in lbs. per kw-hr., of a 1000-kw. unit which has been proportioned for operating conditions of 150 lbs. gauge, dry saturated steam and 28 ins. referred vacuum, at one-half, three-quarter and full loads, with 80% power-factor. From the blading proportions, it is estimated that the net B.t.u. required per brake hp-hr. will be 3300, and from the size of the machine it is estimated that the no-load or friction B.t.u. per hr. for a condensing turbine will be 800,000. The accompanying table outlines the process of estimating the steam consumption from the B.t.u. values given above. The generator efficiency is to be estimated from electrical data.

Throttling Regulation Loss.

The regulation of a turbine by throttling introduces certain losses when the machine is operating at partial loads, because of the effect of throttling on the B.t.u. available to the Rankine cycle. To illustrate the relative magnitude of this throttling regulation loss at different loads for a 5000-kw., 1800-r.p.m. unit, the curve shown in Fig. 6 has been drawn based on operating conditions of 225 lbs. gauge pressure, 125 deg. F. superheat and 28.5 ins. vacuum and on which, for convenience, the load is expressed in percentage of full load. The diagram shows the theoretical reduction in energy available to the turbine at the different fractional loads and is of particular interest because this loss is, in a measure, inherent in the necessary constant-speed regulation of all turbines. It is of interest to note here that designs have been brought out in which the regulation of the turbine was accomplished in a manner intended to reduce the loss at fractional loads which results from constant-speed governing, but that the economy of such designs has followed in general the Willans law and the saving effected has not been large enough to justify the complications introduced.

The curves have all been based on the power output of the generator, which introduces a variable factor due to the generator efficiency being also a function of the load. If the brake hp. of the turbine had been used as the basis for plotting the data the application of the general rules given would have been more strictly correct, but for ordinary comparisons and uses the convenience resulting from the use of the generator output as a load basis for plotting characteristic curves offsets the lack of accuracy.

In addition to those units of economy that have been plotted as a function of the load, the total heat consumption per hr. and other measures of performance can be used if the object of the work being done makes it desirable. The simplicity of Willans law and the similar straight-line relation of the total quantities of heat and the inlet pressure afford an easy means of bringing to the attention of operating engineers the general principles governing turbine economy. An understanding of such points would greatly add to the efficiency of an operating engineer as

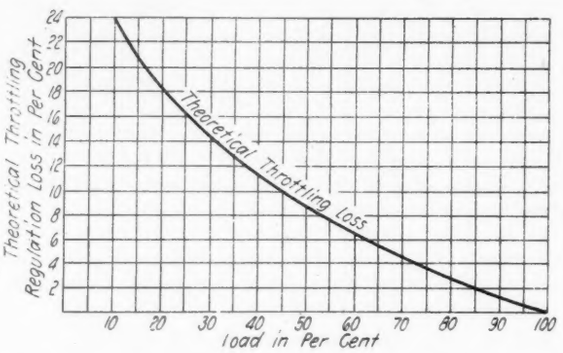


Fig. 6.—Theoretical Throttling Regulation Loss in Relation to Percentage of Load.

it would give him a clearer conception of the working of the machine he handles and enable him to better judge its internal condition by examining the operating records.

It will be noted that certain of the diagrams have the by-pass point marked on them and that they indicate that the straight-line relation between the total quantities and the load is maintained for the condition resulting from admission of steam to an intermediate stage. This feature has not been dwelt upon in the text of the preceding paragraphs, as it is evident that with simple modifications the general principles given apply also for that part of the power output in excess of the by-pass load.

National Electric Light Association Reorganization Plans

Expansion Necessitates Reorganization—Five Departments at Headquarters—Plans for Geographic Divisions, for National Sections, and for Selecting National Executive Committee

By M. H. AYLESWORTH

Executive Manager, National Electric Light Association.

Changing conditions in the use and regulation of electricity have brought about an immediate need for greater expansion of the National Electric Light Association, coupled with a definite national program which shall assure the continued success of the association as the national representative of the electrical industry. For 35 years the National Electric Light Association not only has fulfilled its original object but has courageously assumed the ever-increasing duties and responsibilities which naturally have accompanied the growth, influence and importance of the electrical industry.

M. H. Aylesworth.

Following a general survey made at the request of the national executive committee, upon the recommendation of President R. H. Ballard of the association, it was determined to undertake a program of expansion. In answer to a general letter to executives of all member companies came a demand for increased service in practical co-operation, which resulted in reorganization of the national headquarters staff.

The work of the association, in general, will be directed by the executive manager, and will include the appointment and direction of the headquarters staff, under the supervision of the president, vice-presidents and the national executive committee.

Departments Created at Headquarters.

The organization at headquarters has been divided into five departments, under the direction of the executive manager and the acting secretary.

The company service department, of which Fred W. Herbert is superintendent, is in charge of the rate book and rate research work, which heretofore has been carried on in Chicago, but which lately has become part of the centralized organization. This department is co-operating also with accounting committees and will give service to companies, large and small, in the matter of technical accounting, rates, valuation, production, service and other problems. In so doing it will act as a clearing house for information, experience, statistics and all such matters, thus giving to the companies the advantages of practical development demonstrations of the other company members.

In the short time during which this department has operated, hundreds of inquiries have been addressed by telegram and letter to the superintendent, requesting advice on all classes of operating matters, all of which have arisen in various states and represent the operating problems of the small, as well as the large, electric light and power company.

The department of publicity functions under the direction of George F. Oxley, director of publicity, who will supervise the gathering of educational propaganda from all parts of the country, which will be disseminated to all member companies and to the public as a whole. As part of the campaign to inform the public on all matters affecting the electrical utility, member companies throughout the country will be aided in carrying on this work and in turn will be asked for assistance.

This department will assist in the organization of state committees on public utility information and will act as a clearing house for the committees already formed and those which will be organized during the coming year. The fact is recognized that all publicity problems which are purely local in character or extent must be handled exclusively by local member companies or by state associations or geographic divisions, but it is conceded that many of the problems and conditions which confront the electric light and power companies are common to all and should therefore be handled through the national department.

Features of the plan of this department include the utilization of the moving-picture industry and educational work through the medium of educational institutions.

The department of publicity will supervise the publication of the monthly *Bulletin* of the association and will distribute to the membership let-

ters of information regarding activities of the association and developments within or affecting the industry.

Upon the recommendation of the technical section, approved by the national executive commitee, an engineering department will immediately be established and will function under the supervision of a director. This department is about to engage in gathering statistics and formulating a program on the practical engineering problems which today affect the industry, and will deal particularly with inductive interference, the National Electrical Safety Code, and electrolysis.

A department dealing with committee activity has been formed and is under the direction of A. Jackson Marshall, committee secretary. The service of this department is offered to the various committees to the end that the work of committees may be co-ordinated, duplication of committee activity avoided, and continuity of committee and section activity assured.

The accounting department is in charge of the accounts of the association, as well as the membership lists and the mailing of all material to the membership.

Many prominent executives of central-station companies can testify to the value of the N. E. L. A. educational courses, which have been taken advantage of by the members of organizations of member companies for many years. As in the past, these educational courses will be available through the department of education, headed by Fred R. Jenkins, with headquarters at Chicago. The rapid growth of classes in every state is the best illustration of the appreciation of these courses by members of organizations of central-station companies.

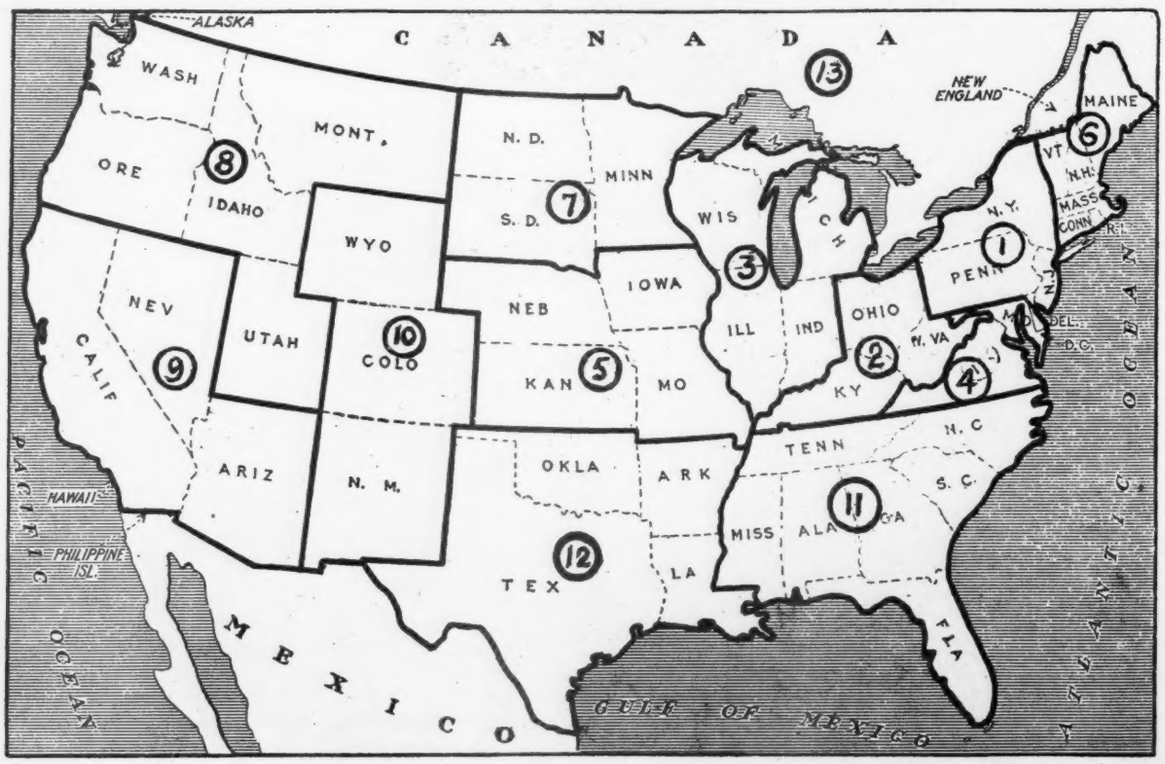
Renewed interest has been shown in the organization of company sections, and a department operating in conjunction with the committee on company sections and employes' clubs is contemplated. The province of this department will be to assist in the organization of company sections and employes' organizations through correspondence, suggestions, and field work where necessary.

Reorganization of Geographic Divisions.

While the organization at headquarters was being perfected, the officials of the national association were obtaining the views of the representatives of member companies in attendance at state association conventions and geographic division conferences, and by written questionnaire. As a result of this investigation, a special committee on reorganization was appointed and the completed plan, visualized by a chart and supported by the proposed constitutional amendments necessary to bring about the machinery for the organization, will be submitted to the membership and will be voted upon at the convention at Pasadena, May 18-22.

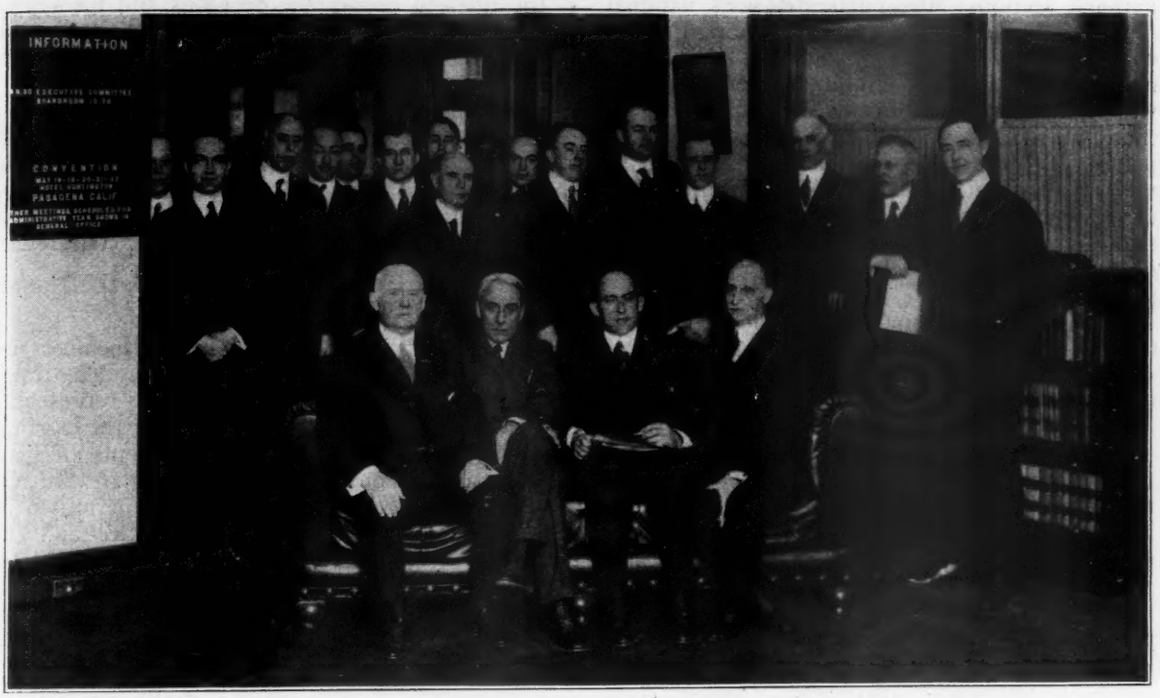
On October 1, 1919, there were five geographic sections of the National Electric Light Association composed of two or more states, and seven state geographic sections. Twenty state electrical or public utilities associations existed which were not affiliated with the National Electric Light Association, although the central-station memberships of these 20 state associations were, with few exceptions, class A members of the national association.

The field work carried on since October 1 not only has demonstrated that the work of the national association should be decentralized to



Proposed Geographic Divisions of the National Electric Light Association.

1, Eastern; 2, East Central; 3, Great Lakes; 4, Middle Atlantic; 5, Middle West; 6, New England; 7, North Central; 8, Northwest; 9, Pacific Coast; 10, Rocky Mountain; 11, Southeastern; 12, Southwestern, and 13, Canadian Electrical Association.



Executive Committee Members of National Electric Light Association in Attendance at Recent Meeting in New York City Headquarters.

Standing (from left to right): S. A. Sewall, Frank A. Birch, Paul Spencer, D. H. McDougall, A. J. Marshall, Walter Neumuller, R. W. Symes, A. Monro Grier, H. C. Abell, W. C. Lounsbury, J. G. Leonard, W. F. Wells, W. H. Atkins, I. E. Moultrop and M. H. Aylesworth. Seated (from left to right): Vice-President W. H. Johnson, Vice-President M. J. Insull, President R. H. Ballard and Vice-President Frank W. Smith.

a considerable extent and that the country should be divided into geographic divisions, but that there is a unanimous demand for the program of the geographic sections committee, which provided for the division of the country into thirteen geographic divisions, including Canada, as defined and named on the accompanying illustration. The national executive committee may, on its own motion or upon the application of one or more adjacent geographic divisions, modify the boundaries or add to or subtract from the existing number of geographic divisions.

Two Methods Planned for Geographic Division Organization.

The proposed plan provides two methods of geographic division organization. Within certain geographic divisions there exist strong and active state electrical associations or state public utilities associations, while in others, where no state association machinery exists, the geographic division carries on the activities of the membership within the division. Thus, it will be seen that the Northwest Electric Light and Power Association, for example, may continue to hold its annual convention and its executive conferences or committee meetings without regard to state boundaries, while the proposed Great Lakes Division, for example, composed of the states of Wisconsin, Michigan, Indiana and Illinois (two of which states had been affiliated with the national association as state geographic sections, while the other two were unaffiliated), will function through a geographic conference, composed of delegates from the four state associations, who will select the officers of the Great Lakes Division and carry on the activities of the national association within the boundaries of the division, the state associations continuing to function in all local matters and, in addition, carrying on their activities as integral parts of the geographic division of the national association.

The purpose of geographic division organization is to decentralize where possible the activities of the national association and harmonize the work of the state association, geographic division and national association through coordination of all committee activities from the state association, through the geographic division, and finally into the executive committees of the national association. Where state public utilities associations exist, it is proposed that the electric light and power branch or division of the state association affiliate as part of the geographic division.

Assistance in financing the geographic divisions will be provided upon budgetary appropriation from the dues paid to the National Electric Light Association. The needs of each geographic division, in budget form, will be presented for approval to the national executive committee by the representative of each geographic division upon the national executive committee.

Four Sections Proposed Within National Association.

As the proposed plan provides for the elimination of all duplication of committee activity, whether in the state association, geographic division or the executive committees of the national association, it is important to provide a distinct line of division in the scope of committees and departments of the association.

Under the proposed plan, there will be four

national sections: the public relations national section, the technical national section, the accounting national section, and the commercial national section. In addition to these sections, which are really departments of the association, there will be general and special committees appointed by the president, whose scope of activity will be territorial or national as, for example, committees on water-power development, electrification of steam railroads, electrical resources of the nation, general membership and national public policy.

There has been comparatively no activity in the national association pertaining to the relationship of the central station with the public, and the proposed public relations national section is intended to provide machinery for the treatment of all subjects relating to management, public policy and relations with the public, such as federal, state and municipal legislation and regulation; federal, state and municipal taxation; uniformity of laws, principles of valuation and depreciation under commission regulation; public information through state committees on public utility information; and public utility financing, including customer ownership of securities; municipal ownership; co-operation within the industry, and all subjects of similar nature which heretofore have been handled by other national sections and committees of the association.

Activities of the Four National Sections of the Association.

The officers of the public relations national section will be a chairman, vice-chairman and executive committee consisting of five members (to be elected at the national convention or national conference of the association), and the chairman of the public relations section of each of the 13 geographic divisions of the association. The activities of the public relations section within the geographic division will be controlled by an executive committee consisting of the chairman of each of the state associations' committees on public relations. The membership of the public relations national section will consist of the executive officers of class A member companies.

The proposed technical, accounting and commercial national sections are substantially the same in character and structure as exist at present, except insofar as their organization is affected by automatic representation from state and geographic divisions, as now proposed.

The chairman of each of the four national sections will become a member of the national executive committee of the association, and will present to the national executive committee the section program for the administrative year for approval.

The public relations national section will be represented on the national public policy committee by four members of the executive committee of the section, who will be recommended by the chairman of the section and indorsed by the chairman of the national public policy committee.

The national executive committee of the National Electric Light Association will, in addition to the chairman or representative of each of the thirteen geographic divisions and the chairman of each of the four national sections, have nine members-at-large (three of whom shall be representatives of manufacturing companies), who will be elected at the national convention or national conference of the association, and the following officers of the National Electric Light Association: President, four vice-presidents, and treasurer, who shall also be elected at the national convention or national conference.

Method of Selecting Members of National Executive Committee.

This method of selection of the members of the national executive committee is democratic and will result in a more equitable representation from the entire country. Under the existing scheme of organization, the presidents of geographic divisions are not members of the national executive committee, but are permitted to attend the meetings of the committee and entitled to cast a total of two votes, while the chairmen of the national sections have not been members of the national executive committee, although permitted to attend meetings of the committee and entitled to one collective vote.

With one or two exceptions, the geographic divisions have either permanently or temporarily organized, and thus the machinery to carry out the program for 1921 and the years to follow is provided, should the program be officially approved by the membership in convention.

The plan of organization provides for complete co-operation between all branches of the industry by inviting the manufacturer, contractor-dealer and jobber to take a definite part in the work of the association, but does not contemplate absorbtion, consolidation or abandonment of the national organizations of any of the different branches of the industry. In other words, the entire plan of organization is based upon the co-ordination of the interests and activities of the industry in the several states, working through state associations, where they exist, and thence through geographic divisions into the executive committees of the national association, so that every member company and its individual membership shall have a voice in the association program and management.

NATIONAL FIRE PROTECTION ASSOCIATION TO MEET.

The National Fire Protection Association will hold its twenty-fourth annual convention in Chicago, May 4-6, with headquarters in the auditorium of the Insurance Exchange building, Jackson boulevard and La Salle street. On May 5 the report of the Electrical Committee of which Dana Pierce, New York City, is chairman, will be made.

MICHIGAN SECTION, N. E. L. A. FIXES ANNUAL CONVENTION DATE.

The Michigan Section of the National Electric Light Association will hold its annual convention at the Hotel Ottawa, Ottawa Beach, Mich., Aug. 24-26. W. M. Lewis, president, and Herbert Silvester, secretary, have charge of the program, which will be announced later.

Electric Drive in a Washington Coal Mine

Description of Installation at Mine of the Wilkeson Coal & Coke Co.—Service Supplied by Central Station—Data on Operation and Economics Effected—Paper Before Seattle Section, A. I. E. E.

By E. J. BARRY
Electrical Engineer, Tacoma, Wash.

At first thought it would appear that selling electric service to a coal mine is on a par with that proverbial expression of futility, "carrying coals to Newcastle," but coal-mining operators in the state of Washington have generally found it to their advantage to market their product and purchase power from central-station companies.

In 1915 the Wilkeson Coal & Coke Co., with mines located at Wilkeson, Wash., concluded that changes in its method of operation were necessary. All the surface coal that could be reached from the mine tunnel had been taken out and the only alternative to closing the mine lay in sinking a slope or shaft and mining coal on another level. The mouth of the slope was approximately 8000 ft. in from the mine entrance, so a steam line was out of the question, and there are natural objections to locating a steam plant in the heart of a coal mine. It was decided to operate the hoist for getting out the coal by electric power purchased from the Puget Sound Power & Light Co., this company agreeing to build a transmission line to Wilkeson and locate a substation near the mine.

Difficulties Encountered in Installation of Power Cable.

Various methods for getting the power to the slope from the company's switchboard, at the mine entrance, were considered and rejected. Although the tunnel was 8000 ft. long, it was only 600 ft. in a vertical line from the hoist location to the outside. There was a ventilation shaft which might have been used, but the possibility of interfering with the ventilation, and possible danger to a cable from cave-ins led to a decision in favor of bringing the power in the entire distance of 8000 ft. by cable.

A No. 0000 three-conductor, rubber-insulated, steel-taped, jute-wrapped cable, suitable for a pressure of 2300 volts, was specified. The intention was to lay this cable in a ditch which parallels a 36-in. gauge track for the mine locomotives. While it seemed a simple question it was found to be a difficult undertaking. For sheer unmanageableness, this cable broke all records, although it looked innocent enough, snugly coiled on the drums, on which it was shipped from the factory. A drum was jacked up, mounted on a shaft to permit rotation, and a mine locomotive was attached to the free end of the cable. It was thought there would be no difficulty, except to splice the cable, which, in theory, would unwind like a sewing-machine bobbin. After 600 ft. of the cable had been paid off, a gradual decrease in the speed was noted, until the drum came to a full stop. Although the locomotive wheels were spinning around, not another inch of cable could be pulled in. The tunnel, it should be explained, was not excavated in a straight line, numerous curves being made, according to whether or not the excavators encountered hard rock. The cable, with its spring-steel armor, would not conform to the winding path and exerted a braking effect against the tunnel walls which was as effective as it was exasperating. There happened to be another locomotive inside and it was pressed into service, but the cable appeared to have taken root and remained a fixture.

It was suggested that the cable be carried in by hand, after being cut to suitable lengths. Experiments demonstrated that a piece 1200 ft. long was the utmost that could be handled, and this amount called for 100 men; that is, a man every 12 ft. The laying of the cable was accomplished in this way, the pieces being spliced together after they had been carried to the locations selected for them.

Motor Equipment.

A 225-hp., 2300-volt, 60-r.p.m. motor, with automatic contactor panel operated by a master controller, was installed for driving the slope hoist. There was also installed close to the hoist a 12 by 14-in. air compressor, driven by a 75-hp., 2300-volt motor. This compressor supplies air for the rock drills. A 1000-g.p.m. pump, operating against a 660-ft. head, and driven by a 250-hp. motor, was installed on the lower slope. Lighting circuits were installed in the hoist room and down the slope, being derived from a 5-kw., 2200/110-volt transformer. This comprises the extent of electrification inside the mine proper.

The question is often asked why coal cannot be mined electrically in accordance with the practice in eastern states, where coal-cutting machinery is in practically universal use. The reason is that the seams of coal in Washington run at an angle like one side of an inverted "V" and therefore cannot be reached with a straight-bar cutting machine.

The practice in Washington is to run tunnels underneath the coal seams and tap the seams into coal cars below. The seams will often cascade into the cars without any assistance on the part of the miner, but more often a powder charge is necessary to dislodge the coal.

As before mentioned, steam locomotives are still used to haul coal in the main tunnel, although storage-battery electric locomotives are

used to bring cars from the working face to the main tunnel. The question of electric haulage, due to curves and grades in the main tunnel, is a serious problem. The steam locomotives, due to smoke and heat, are a nuisance; storage batteries are out of the question, due to grades and curves, and owing to continual settling of the roof and breakage of timbers a trolley wire could not be made to stay in working order more than a few hours, and the danger of shock from the bare wire is quite serious, since most of the mines are thoroughly water-soaked.

Entire Mine Electrified.

It was the intention of the Wilkeson Coal & Coke Co. at first to use electricity for the interior of the mine only, leaving the bunkers steam driven as before, but shortly after the successful inauguration of electric drive the main engine driving the bunkers ran away, the flywheel burst and demolished the engine room.

This experience decided matters for the company. Electric drive throughout was the order of the day, and so thoroughly has this been carried out that even the mine siren is now operated electrically.

The starting effort on coal-handling machinery, especially in cold weather, is very heavy. The coal has to be washed, and naturally the washer freezes up winter nights when the bunkers are shut down. Therefore, motors with wound secondaries are employed to make possible starting up machines on cold mornings. A 100-hp., 2300-volt, 3-phase, 60-cycle wound secondary motor is used to operate the bunkers, and one of similar size and type to operate the washers. Controls for both these motors are placed on the platform, convenient to the bunker foreman, the motors taking the place of the engines in the old engine room. A 35-hp., 440-volt, crane-type motor hauls the loaded car to the top of bunker, where the coal is dumped. This is a balanced load, the empty car going down and assisting the loaded car up the 40-degree slope.

A 25-hp. crane-type motor hauls the rock car out to the rock dump, where refuse rock is disposed of.

A 100-kw. motor-generator set, wound for 110 volts, provides direct current for charging the storage batteries for electric locomotives and electric mine lamps, and also operates an electrically driven coke puller.

Electrically Driven Coke Puller.

The coke puller deserves some mention, as it performs work that is becoming increasingly difficult to get men to do. The Wilkeson Coal & Coke Co. has 160 bee-hive coke ovens into which coal from the mine is poured through an inlet in the roof of the oven. Fire is then started and slow combustion begins, continuing for about 48 hrs., when the coke is ready to be removed. In the old-style method a man, after dislodging the clay-sealed door of the oven, began to rake out the glowing coke. It was hot and back-breaking work, made worse by the clouds of fine dust thrown off the coke as it fell to the ground in front of the oven. The coke was then laboriously shoveled into wheelbarrows and trundled into railroad cars.

The electrically driven coke puller does the work of 30 men. It runs on a track in front of the ovens and can be stopped at any point. It is equipped with a long steel arm on a rack and pinion which drives into a mass of coke and rakes it out to a moving conveyor which forms part of the machine. This conveyor loads directly into the coke carrier on the railroad spur, loading a car in one-tenth the time taken by the old method. Power is transmitted to the mechanical conveyor by an overhead trolley, return being made through a bonded rail.

A motor-driven coke hauler has displaced mule power for hauling coal to be dumped into the ovens. Everywhere electricity has displaced labor wherever it was feasible to do so, and the mine management has not regretted the change in the year of operation since it was made.

Especially noticeable is the better ventilation obtained in the mine through the steadiness of the electric drive, independent of the whims of a fireman, whose ideas of proper steam pressure were apt to vary. A 100-hp. motor driving the fan supplies pure air to the mine workings.

One matter instantly appreciated by the management was the decidedly greater freedom from breakdowns with electric drive as compared with steam. Conveyor-chain breaks had come to be regarded as a necessary evil under the old system, and rarely a day passed without a shutdown of from one to two hours due to this cause. With the steadier electric drive this trouble disappeared almost entirely; the varying engine speeds had been responsible for most of the mishaps in the past.

Energy is taken to the coal company's 4-panel switchboard from the 2300-volt lines of the Puget Sound Power & Light Co., and thence distributed to the mine, bunkers, fan, etc. There is a total connected load of 1120 hp., mostly in large units.

Motors over 35 hp. are all wound for 2200 volts working pressure, and although some fear was expressed that this would be a dangerous voltage to use in a coal mine, five years of operating experience has demonstrated to the contrary.

Economy Effected by Use of Electric Drive in Coal Mines.

Referring briefly to the economic aspect of the use of electricity in mining, the experience of this company has been interesting. Coal at a coal mine is always considered a cheap commodity; such economy in fuel consumption as might be attained by covering long steam lines is seldom practiced. The coal that one time was carelessly shoveled into furnace fires is now sold, bringing a good price in the open market. The labor that did the shoveling is now better employed in getting out more coal. From these two items alone the saving in the use of electricity over steam is placed, at a conservative estimate, at $60 per day. Therefore, in a working year the net gain in favor of electricity from these items alone is $18,000, this item being after all incidental charges of interest, depreciation and cost of purchased power have been deducted. The Wilkeson company is whole-hearted in its appreciation of the advantages and economies of electric drive, and the example encour-

aged many other mining companies in the vicinity to follow suit, with the result that now practically every mine of standing in the state uses electric drive.

During the period that the Wilkeson electrification scheme was being carried out, an interesting experiment was made to determine whether it was commercially possible to recover certain coke by products now being consumed in the bee-hive coke ovens. The method employed was similar to that used in the well-known Cottrell process. High-tension wires were stretched over a funnel through which the coke from a coking oven was passed, and a certain amount of tar product was obtained, but the cost of the method, together with the small amount of by-product obtained, caused the experimenters to abandon the idea. It is possible, however, that something may yet be done along the lines indicated, and if so it will lend additional value to the use of electricity in the coal mine.

N. E. L. A. CONVENTION VISITORS TO SEE MISSION PLAY.

Production Often Called the "Oberammergau of Southern California" to Be Specially Given at the Historic Mission of San Gabriel.

All delegates and visitors who attend the annual convention of the National Electric Light Association at Pasadena, Cal., May 18-22 will have an opportunity of witnessing the famous California Mission Play, as a special performance has been arranged for the convention visitors by the entertainment committee.

The play will be given Wednesday evening, May 19, in a unique little theater constructed

Group of Indians Who Will Take Part in Mission Play During N. E. L. A. Convention at Pasadena.

to resemble one of the old missions of California and is located at San Gabriel, close by the famous mission of that town and near enough to the convention headquarters in the Hotel Huntington to be easy of access.

W. L. Frost, chairman of the entertainment committee, as soon as he received his appointment, arranged with John Steven McGroarty, poet, playwright and historian and author of the Mission Play, to produce it as a special performance during the convention in order to allow the visitors to visualize the early history of California by means of the wonderful pageantry, stirring drama and history of the settling of California by the white race as told in the play.

Another special entertainment arranged for the convention visitors is "La Fiesta de Electra," which will be given at the Hotel Maryland, Pasadena, Friday night, May 21. Charlie Murray, the Mack Sennett comedian, will be master of ceremonies at this event and will stage the electrical festival in which many of the motion-picture stars of Los Angeles and vicinity, will take part. Tentative plans for the festival contemplate a dance in the Hotel Maryland ballroom in conjunction with vaudeville acts staged by Mr. Murray. It is also planned to have the entire hotel made into a "palace of jewels" with some wonderful electrical effects.

ELECTRICAL EQUIPMENT OF AN OREGON LUMBER MILL.

Electric Drive Replaces Steam-Engine Drive—Outline of Motor and Other Electrical Apparatus to Be Installed.

Among the important electrical installations being made in Oregon is that of the Pelican Bay Lumber Co. at Klamath Falls. This new and modern lumber mill is replacing the steam-operated mill that was recently destroyed by fire. The steam-boiler plant, which was not destroyed, will serve to furnish the steam for driving the new turbogenerator and for heating purposes.

In most of the newer mills of the Northwest the motors are driven by energy produced by the mill company's steam-electric unit that forms a part of the plant. In the production of steam the abundance of mill refuse as fuel reduces the power costs to the minimum. In fact, the only condition that might make them lower would be by the use of hydroelectrical energy.

The generating unit consists of an Allis-Chalmers 1000-kw., 480-volt, three-phase, 60-cycle, high-pressure condensing turbogenerator, rated at 3600 r.p.m. and 80% power-factor; the exciter is direct connected to the turbogenerator shaft. The turbine is designed for operation under 150 lbs. pressure and 28-in. vacuum. There is being installed a Schutte-Koerting under-type, multijet condenser, which will produce 28-in. vacuum with injection water at 60 deg. F. Water for the condenser will be supplied by an Allis-Chalmers bronze-filled, horizontal, 8-in. centrifugal pump of 2000-g.p.m. capacity and will be driven by a 30-hp. squirrel-cage induction motor.

The six-panel switchboard to be installed will carry a double exciter panel with voltage regulator, a main generator panel and three double-circuit feeder panels with automatic oil switches; one panel is provided for operation of the lighting circuits.

The log haul is to be operated by a 75-hp., slip-ring induction motor having a full-load speed of 690 r.p.m. equipped with drum-type starter, with resistance for one-minute starting duty and also with wall-mounted oil circuit-breaker having overload and under-voltage release. The motor will be belt-connected to a pulley on the geared mechanism of the log haul.

The right-hand band mill will be driven, through belt and pulley transmission, by a 200-hp., slip-ring motor, having a full-load speed of 580 r.p.m. The left-hand band mill will be driven by a 250-hp. motor of the same type. Both motors will be provided with drum-type

starters, with resistance for one-minute starting duty, and wall-mounted oil circuit-breakers with overload and under-voltage release.

The next heaviest drives, after those of the band saws, are the edger drives. A 48-in. edger will be driven by a 50-hp., squirrel-cage induction motor of the maximum speed of 1750 r.p.m. This will be connected by flexible coupling to the edger shaft and will have no-voltage release starter and overload relay. There will also be a 78-in. edger, to be driven, through the bushing type of flexible coupling, by a 100-hp. squirrel-cage induction motor, with release starter and overload relay similar to those of the other edger motor.

The other squirrel-cage induction motors, which are to be connected by flexible couplings to the driven machines, comprise a 30-hp., 690-r.p.m. motor for the trimmer drive; a 30-hp., 860-r.p.m. speed motor, to operate the slasher; a 50-hp., 1750-r.p.m. motor to drive the lath bolter; a 35-hp., 3510-r.p.m. motor to drive the lath machine; a 7.5-hp., 860-r.p.m. motor for the lath trimmer; a 10-hp., 860-r.p.m. motor for the wood slasher drive; two 5-hp., 1150-r.p.m. motors for the right-hand and left-hand set works.

A 7.5-hp., 1150-r. p. m. motor will be belt-connected to the right and left log-deck chains. The first lines of rolls, both right and left sides, are each to be driven by a 7.5-hp., slip-ring, reversible, back-geared motor, having a drum-type starter, resistance for one-minute starting duty, and wall-mounted oil circuit-breaker, with overload and under-voltage release. The second section of rolls, right and left sides, require two 10-hp., 860-r. p. m. slip-ring, reversible, back-geared motors, and the third section requires two 7.5-hp. motors of similar type. A 10-hp. motor, also of the same type, will serve the first section of rolls back to the resaw, while the last set of rolls will be driven by a 7.5-hp. back-geared motor.

In a similar manner there will be motor drive for speed rolls from edger, resaw transfer, edger feeds, for rolls back of edger, trimmer transfers and numerous conveyors.

A feature of the refuse-handling department is a "hog" machine, to be connected by flexible coupling to a 100-hp. slip-ring motor, of the full-load speed of 865 r. p. m.

The total connected load in motors will be approximately 1200 hp.

ELECTRIC TRUCKS REPLACE OLD ELEVATED TROLLEY ROAD.

Modern application of electricity has replaced what is said to be the oldest electrified elevated railroad in the world. Yielding to the progress of economy and business efficiency, this old mark of earlier industrial progress, which was installed at the packing plant of Armour & Co., Chicago, in 1892, is being supplanted by 60 electric tractors and 600 trailers.

The old elevated transportation, consisting of three miles of track and overhead trolley system, seven trolley cars containing 15-hp., 500-volt motors and 950 trailers of various designs, was installed at a cost of $75,000. It connected all the manufacturing departments and the main shipping stations at the plant, and was made necessary by the congestion of freight and the inadequacy of hand and team trucks. The old system served its purpose well until about three years ago, by which time the Armour plant covered approximately 39 acres and had begun to outgrow its interdepartmental traffic facilities.

At that time several electric tractors and attendant trailers were introduced into the plant.

Elevated Trolley System Now Supplanted by Modern Electric Trucks With Trailers.

They needed no tracks, could go anywhere, hauling 10 trailers loaded with goods from the source of their production to the shipping station or other department, thus eliminating extra handling and hand trucking.

Most of the electric tractors at the Armour plant are the product of the Mercury Mfg. Co., Chicago. According to figures furnished by Armour & Co. the cost of operation per week is

One of a Fleet of Industrial Trucks Installed at Armour & Co. Plant, Chicago.

$58.90 for one tractor and train of 10 trailers, divided as follows: $5.30 for overhead, $4 for upkeep, $3 for power and $36.60 for labor. This unit handles 60 tons of freight per day, or 360 tons per week, and the cost per ton on the above basis is 16.4 cts.

NEW ENGLAND SESSION, I. E. S., LISTS NOMINEES FOR OFFICE.

The New England Section of the Illuminating Engineers Society has prepared the following list of officers to be voted on at the next election: N. W. Goffird, chairman; J. T. Kerens, secretary, and J. W. Cowles, F. A. Gallagher, Jr., L. T. Trowland, C. M. Halstead and David Crownfield, members of the board of governors.

EDITORIAL COMMENT

Marketing Utility Securities Among Small Investors

Public utility companies of all classes, finding it increasingly difficult to obtain capital for financing necessary improvements and extensions through the issuance of bonds and other usual means, are turning more and more for financial support to the small investors in the territories served by them. This is done mainly through the sale of stock to customers, although in some instances sales of short-time notes have been made.

This method of obtaining capital is one that is yet uncertain as to its ultimate possibilities. The great mass of the American people have been trained during the past three years to invest in small securities through the popular sale of Liberty bonds. Millions of people bought the small bonds and so became investors for the first time.

The remarkable success of the Liberty bond sales among small investors has led many industrial concerns to adopt this popular method of financing. The numerous issues of preferred stocks now appearing and available in small units is one phase of the popularization of securities. The so-called "baby bonds" of some enterprises is another phase. It appears that the average man is a potential purchaser of securities now to an extent that he never was before. The spreading of investment directly among the mass of the people is a healthy sign for the country, for the investor knows that disorder does not improve his holdings, and the increased saving due to investment will help to restore the great losses resulting from the recent war.

The offering of securities in popular types and sizes by a public utility is liable to produce any of a number of results. If the small shares or bonds are taken by a fairly large percentage of the utility's customers, such evidence of confidence on the part of the public should make the floating of larger securities easier. However, if small shares are refused or purchased in limited numbers, the borrowing of other money might be made most difficult, for, in the end, confidence is the basis of all credit, and any individual or corporation that is not well thought of or is believed to be unpopular will have difficulty in borrowing. A utility company that can sell stocks or notes or bonds to its average customer or to members of the community where it operates will undoubtedly be in a stronger position than the one that cannot sell securities in such a manner. Where the average man is interested financially he is a booster and will work for the enhancement of his investment. However, the small investor is the very one to make the loudest outcry if his interest is passed or reduced by low earnings or other irregular conditions.

It would appear that the utility company now in a strong position should be able to profit by a sale of popular securities so guarded that interest payments were well assured, while the company in an uncertain or weak position might be courting actual disaster in bidding for such forms of credit. The success or failure of the popular financing of utilities securities probably would hinge as much on the evidence of confidence shown as upon the actual amount of credit secured.

Organization Plans for the N. E. L. A.

The National Electric Light Association, in harmony with the opportunities of the times, is stepping forward to assume its full share in the great reconstruction and reorganization problems of the day. Like many other progressive institutions the association realized that its pre-war organization was not suitable to carry the coming burdens that were sure to be placed upon it, if the full possibilities of growth in the industry were to be lived up to. President R. H. Ballard was far-sighted to see in advance the conditions that had to be provided for and was fortunate in securing the assistance of such a man as M. H. Aylesworth as executive manager to work out and harmonize the many phases of the reorganization plans that were essential to the full functioning of the association.

The plans that have been worked out are nation-wide and look ahead to the steady expansion and healthy growth of the industry for years to come. One of the outstanding features of the new plan is the systemizing and co-ordinating of the work of the association in 12 great geographic divisions in the United States and one in Canada. This co-ordination is intended to bind together the various interests of the industry and to bring into unified action the different state branches of the association. It is evident to those observers acquainted with the state of the industry that a strictly local organiza-

tion is not suitable to meet efficiently the demands of the times, and also that a national organization is too cumbersome to meet and keep pace with all developments. The organization of the geographic divisions fills in the gap between the local or state divisions and provides means for the formation of a more flexible national organization. The various geographic divisions are so laid out that the different states within the divisions have many joint interests and can carry on their common work intensively, thus solving among themselves many of the problems with which they are peculiarly fitted to deal. Other problems of wider scope can thus be given the time and attention of the national organization. On account of the relatively small number of separate units, or geographic divisions, in the national body less time will be required to transact business coming before it.

The reorganization plan includes as an important feature a new section to be known as the "Public Relations Section." As might be assumed from its name this section will have much to do with the growing idea of "the public be served." The reorganization also contemplates a more democratic basis of representation and election of national executive committee members than now prevails. It is to be hoped the association will be able to put into effect at the coming national convention the greater portion of the new organization plans that have been so well worked out.

Hydroelectric Developments and Electric Construction

With the national water-power bill in a fair way to become a law, the electrical industry can look hopefully upon the possibility of an impetus in construction work in the reasonably near future. Practically all of the development work that will occur if the water-power law is enacted will involve the installation of generating and line equipment and, consequently, motors, transformers and other kinds of electrical apparatus for converting electricity into heat and other useful energy. For the electrical energy that is generated will be used. Water-power development projects are usually considered and mentioned as projects requiring the construction of dams and sluices and the installation of gates and hydraulic turbines. The fact that a large portion of the construction work on these projects and a large part of the machinery installed is entirely electrical is not ordinarily considered. Moreover, the greater portion of these projects is developed for the purpose of producing electrical energy, a fact that presages the use of large quantities of motors, furnaces, household appliances and other equipment. From these considerations one sees that water-power projects are essentially electrical.

Since approximately 50,000,000 of the 60,000,000 hp. available water-fall energy of the nation is at present undeveloped, one can scarcely visualize by words the amount of work and equipment required for anything like complete development. The amount and variety of electrical equipment required to utilize this enormous quantity of natural energy is beyond comprehension. Stated in numbers of motor units, electric furnaces, electric flatirons, ranges, vacuum cleaners, industrial ovens, electric washers and other devices that the energy would propel, the amount would be meaningless because of its magnitude.

These considerations suggest the extraordinary value of water-power development to the electrical industry. Every branch of it—engineers, contractors, manufacturers, jobbers and all—will share in the prosperity that the development will entail. More and larger generator sets would be designed and constructed, more transmission lines erected, more and larger central stations be constructed, and more central-station, industrial and household equipment sold than at present. In addition six tons of coal per year would be saved for every horsepower-year of hydroelectrical energy utilized. This saving in coal would constitute a considerable element in itself that would have the effect of reducing coal prices generally to the central stations that are compelled to use it and would relieve many of using it altogether.

But this desirable and needed development of water-power resources, with its consequent benefit to the electrical industry, cannot occur until Congress passes a sensible law to permit it because approximately 80% of the available power sites are on the public domain. With satisfactory legislation enacted, development can proceed so that the public can realize on the natural resources that are now wasting. The development of several large projects will proceed, in fact, as soon as proper legislation is enacted. A reasonably satisfactory law permitting the development of water-power sites on the public domain has been prepared and is awaiting action by Congress. It is not without its enemies and will not be passed unless the united effort of those who are interested in terminating the present shameless waste of natural resources is exerted for it. The large amount of construction work that will follow its enactment makes the law particularly desirable to every man engaged in the electrical industry. Each should contribute his effort toward obtaining its enactment.

CURRENT EVENTS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

ELECTRICAL APPARATUS INDUSTRY GROWING IN CANADA.

Manufacturing of Appliances Now Going On in 68 Plants Which Have a Total Capital Investment of $43,285,405 and 8863 Employes.

The manufacture of electrical apparatus is one of the newer Canadian industries which is making excellent progress. The report of the Dominion Bureau of Statistics for 1918 just issued shows that there were 68 plants in operation throughout the Dominion. The total capital investment for the Dominion was $43,285,405, of which $10,636,572 was in land, buildings and fixtures; $6,518,132 in machinery and tools; $17,071,528 in materials, stocks in process, finished products, fuel and miscellaneous supplies on hand as per inventory, and $9,059,173 in working capital.

The number of persons employed in the industry was 8863, of whom 6895 were male and 2268 female; while the salaries and wages paid during the year totalled $8,456,705. The value of all materials used in 1918 is given as $13,780,567. The total selling value of all articles produced in Canadian works in 1918 is returned at $30,045,399, the value of the principal products being dynamos, generators, and convertors, $1,504,443; transformers, $2,291,874; switchboards, panels, etc., $990,898; motors, $2,727,673; storage batteries, $212,624; primary batteries, $1,397,635; incandescent lamps, $1,525,198; insulated wires and cables, $5,154,984; other electrical machinery, $1,738,085; carbons, $1,362,666; other miscellaneous products, $8,492,843.

Canada is a heavy importer of electrical apparatus the value of her importations of this class having been $11,005,753 in 1919. In 1915 it was $6,053,689. These goods came chiefly from the United States, which in 1919 is credited with $10,887,657 worth. Canada's export trade in these products is growing rapidly. In 1915 it was valued at $97,890; in 1919 the value was $2,167,545. France was the best customer, with imports in 1919 of $706,580.

CONSERVATION OF FUEL WILL BE N. E. L. A. CONVENTION TOPIC.

Many Reports and Papers on Fuel Problem and Hydroelectric Development to Be Presented for Consideration of Delegates.

Consideration of the fuel problems confronting the United States, with a view to conservation and more efficient use of coal through the medium of electrical energy properly and efficiently distributed, will be the dominating note of the annual convention of the National Electric Light Association in Pasadena, Cal., May 18-22.

Shortly after the entrance of this country into the war, it became apparent that the fuel supply was one of the big factors in the matter of production. Since that time the increasing use of electricity in the most economical manner has been the aim of those studying the problem.

Foremost among the questions touching this phase of the electrical industry are the electrification of steam railroads, the interconnection of transmission lines of electrical energy producing companies so that their production capacity may be maintained at a maximum and so that the electrical load may be shifted in such manner as may be necessary to most scientifically and economically meet demands, and the development of all available hydroelectric energy as rapidly as construction may be financed. These matters will be covered in detail by reports and papers to be presented at the convention as the result of more than a year's work on the part of committees and individuals.

The tremendous amount of money needed by the electrical industry for financing extensions of service and expansions of plants has attracted the attention of bankers throughout the country, and representatives of several of the large banking interests will attend the convention.

S. E. D. PRESIDENT OUTLINES OUTLOOK FOR 1920.

Issues Open Letter to Members and Non-Members Urging Support and Co-operation in Work of Society During Coming Year.

W. W. Freeman, president of the Society for Electrical Development, has sent out a letter to all members of the society, and also to corporations and individuals not members, in which he outlines the plans of the society for the coming year and asks the co-operation of all electrical industries in the work of the organization.

The society has already outgrown its first quarters at 29 West 39th street and moved on April 26 to larger quarters at 522 Fifth avenue, New York City.

Mr. Freeman's letter follows:

"Upon my election as president of the Society for Electrical Development, in succession to Henry L. Doherty, and before acceptance of such office, I felt it my duty to familiarize myself fully with the work being performed by the society, and especially with the outlook as to effective and necessary service to the electrical industry in the immediate future. As an advo-

cate and supporter of the society from its beginning, I believed that a very important work had been carried on under the leadership of Mr. Doherty and the efficient executive direction of Mr. Wakeman, but upon personal examination of the office records and files of the society I found that the scope and value of the work of the society during the past few years were far beyond my expectations, and I believe far beyond the realization of the electrical industry in general.

"It is a very pleasant duty to report such fact and to solicit your active co-operation in extending the work of the society during the coming year. Let me say at the outset that the society does not duplicate the efforts of any other existing organization. Its relations with the other organizations within the industry are cordial and intimate. There will be the closest co-operation in order to obtain the best results without any conflict of interests or duplication of efforts.

"The society has had remarkable success in obtaining widespread national publicity for 'everything electrical.' This has been accomplished through the mediums of the daily newspapers, popular weekly and monthly magazines, and numerous trade journals, educating the public as to the uses and advantages of electric service for both industrial and domestic use. No other organization is equipped to render this particularly important service. I am very strongly of the opinion that this one service of national electrical propaganda is alone worth more than the full membership dues. It has contributed very directly to the increased demand for electric service throughout the country, which has been so pronounced during the past year or two. The cumulative value of such nation-wide propaganda for electric service is incalculable.

"The further services rendered by the society to its members and to the industry are varied and extensive. The vast amount of literature which is prepared and distributed is of a high quality. The 'Monthly Sales Service' and other booklets, which go out regularly, have been commended by many members in the strongest terms in unsolicited communications. The society has established a 'Special Service Department,' the staff of which responds daily to calls from members who ask for advice and assistance in advertising their sales campaigns, window displays, or store arrangements, letters to prospective purchasers, and other assistance.

"There can be, in my opinion, no doubt in the mind of anyone who will inform himself as to the facts concerning the great service which this society is in a position to render to the industry. Its organization is complete for present operations and will be expanded effectively as the resources permit. In response to the personal request of the president, the large manufacturing and central-station interests, which had withdrawn from the society during the war period, have, without a single exception, agreed to renew their memberships and to co-operate actively with the organization during the coming year. Such companies include the General Electric Co., Westinghouse Electric & Manufacturing Co., Commonwealth Edison Co. of Chicago, Philadelphia Electric Co., the Edison Electric Illuminating Co. of Boston, the Consolidated Gas, Electric Light & Power Co. of Baltimore, and the Cleveland Electric Illuminating Co."

N. E. L. A. EXECUTIVE COMMITTEE ACTS ON CONSTITUTION.

Approves Reorganization of Headquarters and Material Changes to Be Made in Form of Organization Throughout Country.

Final approval was given by the executive committee of the National Electric Light Association to the proposed changes in the constitution of the association, providing for the reorganization of the New York City headquarters and material changes in the form of organization throughout the country at a meeting recently held at headquarters. Copies of the plan of reorganization and a chart visualizing this plan will soon be forwarded to the member companies, and will be submitted for approval at the annual convention in Pasadena, Cal., this month. The executive committee meeting was attended by 16 members and was presided over by Vice-President Martin J. Insull, Commonwealth Edison Co., Chicago.

At the meeting candidates for membership in the association were elected to membership as follows: 27 in Class A; 604 in Class B, 4 in Class C, 56 in Class D, and 223 in Class E, making a total of 913 new members elected.

In order that the members of the executive committee might be conversant with the work now being carried on at national headquarters, Executive Manager M. H. Aylesworth reviewed the activities of the several departments for the month of March, and presented the first monthly reports submitted by the heads of each department.

Under the heading of "constitutional amendments," the executive committee voted to change the name of the "Technical and Hydro-electric Section" to the "Technical Section."

Approval was given to the formation of two company sections, one at the West Penn Power Co., Pittsburgh, Pa., and the other at the Penn Central Power Co., Altoona, Pa.

In furtherance of the plan for equipping national headquarters with a staff of experts responsible for the carrying out of the work of the association upon recommendation of the several committees, Executive Manager Aylesworth was authorized to establish an engineering department. He was authorized to employ W. J. Canada, formerly of the U. S. Bureau of Standards, as engineering expert, and to employ some other expert on inductive interference as consulting engineer.

Following the announcement that Dr. Ryan of Leland Stanford University, who has conducted insulator studies for several years, has resumed this work after an absence of about a year, the executive committee voted that the subcommittee on insulator maintenance be instructed to pursue insulator studies with the understanding that the work necessarily must carried on by its successor next year.

Authority was granted by technical section to take up research and investigation on cable dielectrics, an appropriation being made for the purpose.

Indorsement was given the movement for the establishment of a United States Department of Public Works, being forwarded by the National Department of Public Works Association. The committee favors the establishment of a Department of Public Works by a suitable modification of the existing Department of the Interior, excluding therefrom the non-related bureaus and officers, but is opposed to the creation of an entirely new and distinct department.

I. E. Moultrop, chairman of the technical section, was appointed by the Executive Committee to represent the National Electric Light Association on the Advisory Council of the Engineering Council now considering mapping of the United States.

PLANS FOR I. E. S. MEMBERSHIP DRIVE DEVELOPING.

Preliminary plans for the membership drive by the Society of Illuminating Engineers are maturing rapidly. A nationally organized committee, to be directed from national headquarters in New York City, is proposed. The members of the committee will represent all phases of lighting industry, from the manufacturer to the technicist.

The field from which new members are sought has been canvassed thoroughly and classified into groups, which include electric central stations, gas central stations, incandescent lamp manufacturers, gas lighting appliance manufacturers, electrical supply and machinery manufacturers, and several other technical and business groups. A vice-chairman of the committee will be in charge of the canvass of each group. In addition, a geographical grouping will be made with as many vice-chairmen as are necessary.

It is expected that the committee organization will be completed within a few weeks.

CONFERENCE CLUB TO HOLD MEETING IN JUNE.

The first meeting of the Conference Club in which all branches of the electrical industry will have a representation will be held at White Sulphur Springs, W. Va., on June 17-19. Twenty-one prospective members have been invited to attend the meeting. The most important work to be accomplished will be the consideration of the report of a committee on constitution and by-laws.

NEW GEOGRAPHIC DIVISION WILL HOLD JUNE CONVENTION.

The recently organized North Central Geographic Division of the National Electric Light Association will conduct an intensive membership campaign prior to its first annual convention which will be held in the Radisson Hotel, Minneapolis, Minn., June 16-17. The division is composed of the Minnesota and South Dakota Electrical Associations and includes in its jurisdiction North Dakota, which was without a separate electrical association. The new division expects to have every light and power company in the three states a member of the N. E. L. A. and in addition to have at least 1000 individual members when the June convention is held. T. D. Crocker, Minneapolis General Electric Co., is president of the division, and M. Barnett, Northern States Power Co., St. Paul, Minn., secretary, Mr. Barnett acting in a temporary capacity as it is the intention of the division to employ a paid secretary.

SIX EDUCATIONAL INSTITUTIONS BENEFIT IN VAIL WILL.

Six educational institutions in the East will benefit to the extent of $400,000 under the will of the late Theodore N. Vail, who at the time of his death two weeks ago was chairman of the board of directors of the American Telephone & Telegraph Co. To Princeton University and Dartmouth College $100,000 each is bequeathed, while the sum of $200,000 is to be equally divided between the Massachusetts Institute of Technology, Harvard University, Middlebury College, Middlebury, Vt., and Phillips Exeter Academy, Andover, Mass.

AMERICAN WELDING SOCIETY HOLDS ANNUAL MEETING.

Various Phases of Arc Welding Discussed in Papers at Convention of Society in New York City This Week.

Technical papers on welding, business transactions and election of officers featured the annual meeting of the American Welding Society, held in New York City April 22. The business session was concerned principally with amendments to the by-laws of the society, which dealt with conferring voting privileges on class "D" members, with providing for local sections and permitting local representation on the board of directors. The matter of reducing the representation of the American Welding Society in the American Bureau of Welding was referred to a committee, which will also prepare a program of the activities of the society.

The papers presented at the meeting included one by William Spraragen, of the University of Washington, on the speed of metal arc welding; one by H. L. Unland, General Electric Co., on automatic arc-welding machines, and one by Stuart Plumley, Davis-Bournonville Co., on recent developments in gas cutting.

Mr. Spraragen discussed several phases of arc welding and illustrated his remarks by means of curves. The data presented were collected from the welding investigations carried on during the war in an effort to replace the riveted joints in ships with welded joints. He said that the method of stating rate of welding in terms of the progress per unit of time and the thickness of plate is unsatisfactory for comparative purposes. A better method is to state rate in pounds of metal per hour deposited. Only 70% of the melted electrode goes into the joint; about 12% is burned and 18% otherwise wasted. The preparation of the joints and the skill of the operator are important factors in making a satisfactory joint. Too much current causes too

rapid deposit. The voltage across the arc should be a minimum. A negative electrode has a minimum consumption. Insofar as the steel plate is concerned, there is little to choose between a-c. and d-c. supply.

TELLS IMPORTANCE OF ELECTRIC LIGHTING TO INDUSTRY.

At the regular weekly luncheon of the Electric Club of Chicago, April 27, some novel ideas regarding the functions and relations of the electrical and illuminating engineer, the electrical supply jobber and the electrical contractor-dealer with respect to the aesthetic and practical aspects of lighting were presented by Guy Norton, sales manager of the Duplexalite Lighting Works of General Electric Co., Schenectady, N. Y. Mr. Norton had as his subject "The Importance of Electric Lighting to the Electrical Industry."

FINISH WORK ON PROGRAM FOR N. E. L. A. CONVENTION.

Interest in Annual Gathering of Central-Station Industry Leaders Grows as Time of Pasadena Meeting Approaches.

Details of the business and entertainment program at the Pasadena convention of the National Electric Light Association have been completed. So far as arrangements are concerned everything is in readiness and the Hotel Huntington is awaiting the arrival of N. E. L. A. members and guests at Pasadena on May 18.

During the past week interest in the convention has increased, according to word reaching the N. E. L. A. national headquarters in New York City, and practically all of the leading members of the industry have signified their intention of attending.

John B. Miller, president of the Southern California Edison Co., and chairman of the Convention Committee, was at national headquarters, April 24, and said that he was sure the plans made for the convention would meet the approval of those who attended. A. Emory Wishon, president of the Pacific Coast Section, who has been visiting many cities in the East, was also at headquarters and reported a lively interest in the convention.

Dr. E. B. Rosa, chief physicist of the U. S. Bureau of Standards, has agreed to attend the convention and will deliver an address at one of the sessions.

Among the leaders in the central-station industry in the East and Middle West who will attend the convention are: S. J. Mitchell, president, Electric Bond & Share Co., New York; Samuel Insull, president, Commonwealth Edison Co., Chicago; F. W. Frueauff, vice-president, H. L. Doherty Co., New York; J. W. Lieb, vice-president and general manager, the New York Edison Co.; M. S. Sloan, president, Brooklyn Edison Co., Inc.; Charles L. Edgar, president, the Edison Electric Illuminating Co. of Boston; W. W. Freeman, president, Union Gas & Electric Co., Cincinnati; O. D. Young, vice-president, General Electric Co., Schenectady, N. Y.; Guy E. Tripp, chairman board of directors, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; Col. H. M. Byllesby, H. M. Byllesby & Co., and John F. Gilchrist, vice-president, Commonwealth Edison Co., Chicago.

J. E. Davidson, vice-president and general manager of the Nebraska Power Co., Omaha, Neb., visited N. E. L. A. headquarters, New York, April 24, and announced that great interest in the convention is being shown in the middle west. He reports that Nebraska, Kansas and Iowa will have a large delegation, it being probable that there will be at least one special car of delegates from each state.

DISCUSS USE OF ELECTRICITY IN IRON AND STEEL PRODUCTION.

Max Albert Whiting, of the power and mining enginering department of the General Electric Co., Schenectady, N. Y., was the speaker at the meeting of the New York Electrical Society, April 21, having as his subject, "Electricity in the Production of Iron and Steel." Mr. Whiting described the course of iron from the ore fields to the finished product and pointed out that in this course it is handled largely by machinery using electric motors. Secretary George H. Guy of the society announced that 173 new members had been admitted so far this year, making the total membership of the society 825.

EXPLAINS N. E. L. A. PLANS TO MANUFACTURERS' CLUB.

M. H. Aylesworth, executive manager of the National Electric Light Association attended a convention of the Electrical Manufacturers' Club at Pinehurst, N. C., April 14-18. Mr. Aylesworth addressed the club on "The National Electric Light Association, Its Organization and Its Purposes." He outlined new developments in the association and the contemplated expansion of its activities, pointing out to the manufacturers present exactly how the association could assist both the central stations and the manufacturers in being of mutual benefit to each other and to the industry as a whole.

ELECTRIC HEATING DISCUSSED BY ROCHESTER ENGINEERS.

At the April meeting of the Rochester (N. Y.) Section of the American Institute of Electrical Engineers held April 23, Wirt S. Scott, manager of the industrial heating section, supply department of the Westinghouse Electric & Manufacturing Co., spoke on "Industrial Electric Heating as Applied to Medium and Low Temperature Process." Mr. Scott showed how electricity can be substituted to good advantage where at present coal, gas, coke and other fuels are being used.

WORLD'S LARGEST HYDROELECTRIC PLANT IS PLANNED.

The construction of a hydroelectric plant, larger than any now existing in the world, will become possible, and it is reported plans are already under way for it, if Congress passes the water-power leasing bill now held up in conference by Senate and House committees.

The plant will be located on the Priest Rapids site on the Columbia river, near the Oregon-Washington border, where there can be developed a hydroelectric plant with a maximum capacity of 700,000 hp. in high water and 400,000 hp. in low water. The work will involve the construction of a dam 85 ft. high across the Columbia river.

TAYLOR SOCIETY WILL HOLD MEETING IN ROCHESTER, N. Y.

The Taylor Society, the national organization for the promotion of scientific management in industry, will hold a meeting in Rochester, N. Y., May 6-8, under the auspices of the Industrial Management Council and the Manufacturers' Council of the Rochester Chamber of Commerce. At the meeting a number of prominent manufacturers, industrial engineers and labor authorities will discuss the present labor situation and other matters of similar interest.

A. E. WISHON ADDRESSES SCHENECTADY SECTION, A. I. E. E.

A. Emory Wishon, president of the Pacific Coast Section of the National Electric Light Association and general manager of the San Joaquin Light & Power Co., Fresno, Cal., was the principal speaker at the April meeting of the Schenectady Section of the American Institute of Electrical Engineers, April 21. Mr. Wishon's subject was "Self-Interest in Electrical Development," in which he advocated a definite campaign of education among all the individuals and concerns that utilize, or should utilize, electrical energy.

PREDICTS BIG FUTURE FOR RENEWABLE-FUSE INDUSTRY.

Executive of Federal Electric Co. Makes Statement That Protection Afforded by Safe Renewable Fuses Makes Unlimited Field for Them.

"There never was a time in the history of the electrical industry," according to a statement recently made by C. B. Graves, general sales manager of the Federal Electric Co., Chicago, "when the proper safeguarding of circuits in all electrical machinery has been given such careful consideration as at the present time. The necessity for economy and the reduction of all unnecessary and expensive waste has brought the merits of the renewable fuse to the front.

"When the great savings that could be effected by the use of renewable fuses became generally appreciated an enormous demand ensued, and to meet it numerous kinds of renewable fuses were placed on the market. For a brief period proper consideration was not given to the safety of the average renewable fuse. Its sudden popularity and rapid growth caused this important factor to be neglected, in many cases, chiefly for reasons of economy.

"Most renewable-fuse manufacturers had no time to perfect their fuses during the war, but the federal laboratories fortunately found time to make several remarkable improvements. It was not until after the signing of the armistice and conditions became more settled that the problem of making the renewable fuse absolutely safe was generally considered.

"Because of the temporary delay in perfecting the renewable fuse, the electrical industry was skeptical for a while of its value. This objection has been gradually overcome by means of continuous educational advertising in publications reaching practically every industry where renewable fuses are used.

"The future of the safe renewable fuse is practically unlimited because of the protection it gives to valuable motors and machinery equipment, which at present are very expensive and difficult to replace. Such a renewable fuse will enable the manufacturer to save considerable, not only in equipment, but in the actual cost of fuse maintenance."

COMING CONVENTIONS.

Electric Power Club. Annual convention, Chattanooga, Tenn., May 5-8. Headquarters, Signal Mountain Hotel. C. H. Roth, secretary, 1416 West Adams street, Chicago, Ill.

American Association of Engineers. Annual convention, St. Louis, Mo., May 10 and 11. Headquarters, Planters Hotel. Secretary, C. E. Drayer, 63 East Adams street, Chicago.

Electrical Supply Jobbers' Association. Annual convention, Del Monte, Cal., May 12-14. Franklin Overbagh, general secretary, 411 South Clinton street, Chicago, Ill.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 13-15. Headquarters, Hotel Galvez.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 29th street, New York City.

Missouri Association of Public Utilities. Annual convention, Jefferson City, Mo., June 3-5. Secretary, F. D. Beardslee, St. Louis, Mo.

North Central Geographical Division of National Electric Light Association. Annual convention, Minneapolis, Minn., June 16-17. Headquarters, Radisson Hotel. M. Barnett, Northern States Power Co., St. Paul, Minn., secretary.

Iowa Section, National Electric Light Association. Annual convention, Colfax, Ia., June 23-25. Rex H. Clark, assistant secretary, Des Moines, Ia.

American Institute of Electrical Engineers. Annual convention, White Sulphur Springs, W. Va., June 29-July 2. Headquarters, The Greenbrier. F. L. Hutchinson, secretary, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 13-16. Secretary, D. L. Gaskill, Greenville, O.

Pacific Coast Section, American Institute of Electrical Engineers. Annual convention, Portland, Ore., July 21-23.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., Aug. 24-26. Headquarters, Hotel Ottawa. Herbert Silvester, secretary-treasurer, Ann Arbor, Mich.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6. Secretary, W. H. Morton, 110 West 40th street, New York City.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

ILLINOIS UTILITY COMPANIES TO CONFER ON IMPROVEMENTS.

State Commission Holds Public Hearing to Obtain Views of Bankers, Public Service Company Heads and Other Interested Parties.

That more than $100,000,000 worth of new construction work and general improvements scheduled by the public utility companies of Illinois in 1920 may be abandoned because of the excessively high interest rates is evidenced by the fact that the Illinois Public Utility Commission has arranged to hold a public hearing this week, at which bankers, public service company heads and other business men will give testimony in an effort to correct the situation. It is expected that every utility company of size in the state will join in the hearing.

The problem has been gravely discussed by utility managers and bankers for a number of months. To a large extent the real situation has been befogged by discussions over rates in which politics has played a considerable figure. Students of the utility problem have seen that inasmuch as the sound growth of the country's business rests largely upon the efficiency of the light, heat, power, transportation and communication companies, if they are to continue to rely on private capital for development a constructive program must be devised that will enable them to expand.

It has been agreed that unless they can attract private capital they cannot grow; their services must become increasingly inadequate, with increasing handicap to the country's industry, and the public must suffer. The fact that the Interstate Commerce Commission and other regulatory bodies formerly had taken the rate question to be whether a public service agency under private ownership could "scrape" through set a precedent for many local regulatory bodies, who operated on the theory that if a company could avoid actual bankruptcy no relief should be given. The result of this continued battle between solvency and insolvency has been the undermining of credit and the consequent demands from investors of higher interest rates.

Public improvements in the shape of extensions to electric lighting plants and transmission lines, street car lines, gas company mains and telephone equipment by the company, or companies, serving a community, are not built out of the rates obtained for the essential services rendered. New money, obtained from the thrifty who constitute the investing public, is the basis for the extensions of service. That money must be obtained in competition with all other industry, both through adequate assurance of safety of principal and through the offering of interest rates that are attractive.

The utility company must invest $1 of capital in plant and equipment in a community—cement, stake, tie or bury it in the ground or hang it on transmission lines of the city or town it serves—for each 25 cts., or thereabouts, of gross revenue it can expect back in the form of rates in a full year. In other words, its "turnover" of invested capital is only once in each four or six years. The "turnover" of the utility industry is the slowest of any known industry, and its investment in permanent improvements in the community is by far the heaviest of any industry in proportion to gross revenue received.

Under the tentative plan arranged by the Illinois Public Utility Commission the various phases of the situation to be considered at the coming public hearing will be:

The plans of the utility companies to extend their respective properties to meet the public demand for service, as required by law.

The methods adopted by the utility companies to raise additional capital to pay for new construction.

The attitude of the banks and the dealers in bonds and stocks with respect to the sale of utility securities.

The attitude of the investing public towards utility securities; the rate of return they require on investments in such securities and the rate of return to the utility on its property to enable it to pay the investor the interest or dividend that he demands.

Are the present high rates for money temporary or permanent?

One reason that prompted the Illinois commission to call the special hearing was the fact that the Chicago Telephone Co. recently withdrew an informal request that the commission act speedily on an application from the company that it be given authority to issue $10,000,000 of 7% notes to carry on new construction work, explaining that the interest rate asked—9%—was prohibitive. This money, had it been obtained, was to have been used in developing and improving Chicago's telephone system and would have been spent in its entirety during 1920.

DIAGRAMS SHOW HOW REVENUE OF COMPANY WAS USED.

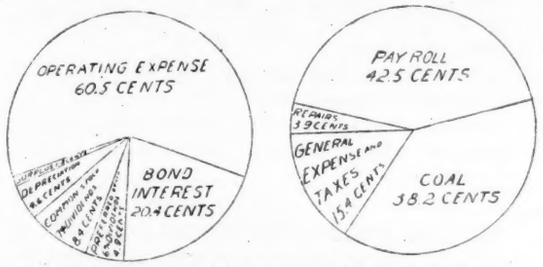
In its annual report to the stockholders for the year 1919 the Public Service Co. of Northern Illinois makes use of an interesting diagram shown herewith to illustrate how each dollar of the company's revenue for the year was used.

The revenue—operating and other income—shown in the report was $9,325,913.23 The operating expense was $5,646,340.19.

The disk shown on the left represents a dollar—any dollar of the 9,325,913.23 dollars received.

The first piece taken out of this typical dollar, was 60.5 cents, and it went to pay the operating

costs. The next segment, 20.4 cents, paid the bond and note interest—$1,902,706.25. Then came a smaller piece of the dollar worth 4.9 cents. The 9,325,913.23 pieces of this size piled up represented $455,280, the sum of 6% on the preferred stock. A larger piece of each dollar —8.4 cents—was then cut off and the aggregate of these portions figured up $781,191.25 and was used to pay 7% dividends on the common stock. After 4.6 cents was taken to make up the item of $430,660, set aside for depreciation, a



Utility Company Uses Diagrams to Show Distribution of Its Yearly Revenue.

tiny sliver valued at 1.2 cents was all remaining. This sliver from each of the 9,325,913.23 dollars made up $109,735.28, which was carried to the reserve.

The disk on the right represents any one of the 5,646,340.19 dollars paid out for operating expenses. To meet the payroll, which aggregated $2,397,996.78, a section of it worth 42.5 cents came out of each of these 5,646,340.19 dollars. To pay for coal used costing $2,157,749.99, the section taken from each dollar was worth 38.2 cents. A little over 21 cents remained and of this 15.4 cents was required to pay taxes and general expenses which totalled $868,088.25. There was left 3.9 cents and that taken from each of the 5,646,340.19 dollars realized $222,505.17, which amount was used to pay for supplies and repairs.

COMMISSION REFUSES TO ORDER GAS SERVICE DISCONTINUED.

Fort Plain (N. Y.) Gas & Electric Co., Though Losing Money in Operation Cannot Cut Out Service Is Ruling Made.

Under an agreement reached with the New York State Public Service Commission on April 7 the Fort Plain Gas & Electric Co. will continue supplying gas to Fort Plain customers until Sept. 15, 1920. The company some time ago announced its intention of discontinuing gas operations but the commission directed it to show cause why it should not continue the service.

At the hearing L. B. Moore, village attorney of Fort Plain, informed the commission that the company is getting its customers to use electricity for cooking in place of gas; that in last January there were only 119 gas meters in use against 160 in the preceding October. At the present time 108 homes are using gas for cooking purposes. Mr. Moore suggested that the company continue its supply until Oct. 1 and if necessary be granted a higher rate. President A. D. Sheffield of the company asked that gas operation be allowed to continue only to Sept. 1 with the understanding that the village would not further oppose the company's plans. The village, through Attorney Moore, refused to enter into this plan.

Mrs. A. Green, a customer, urged the necessity of gas as a cooking factor and thought that because of the company's electric energy operations it should continue the sale of gas even at a loss, but Chairman Hill, of the commission, informed her that under the law gas and electric departments must stand on their own merits and that rates for electrical energy cannot be fixed so as to carry a losing gas department. The company's loss from gas operation in 1919 was $3785, according to a statement filed with the commission.

WOULD NEED $200,000,000 IN EQUIPMENT TO PREVENT DROUTH.

It is estimated that the present spring drouth in California would take $200,000,000 worth of equipment to supply water. While the water is there for both power and irrigation purposes it is largely in an unavailable and undeveloped form for use to help save the crops. Every industry, bank, bond house, broker, jobber and working man in the West is interested in increased electrical development.

As one illustration of the value and need for hydroelectric development in California alone, A. E. Wishon, of the San Joaquin Light & Power Co., Fresno, Cal., recently stated that his company now has 2000 applications on file for power service, 1200 of the applications being for agricultural service and 600 of these are for the development of new lands, requiring new homes, barns, buildings and farm equipment.

According to Mr. Wishon the San Joaquin company needs $26,000,000 in the next four years to expand to meet the needs of the territory it serves. Thus it makes business for everybody from the day laborer and manufacturer to banker and bonding house. In expending $26,000,000 to create additional power for public needs it will make possible the expenditure of ten times that sum by individuals and industries.

WEST VIRGINIA COURT RULES IN TRANSMISSION CASE.

The Supreme Court of Appeals of West Virginia, in the case of the Mill Creek Coal & Coke Co., recently ruled that the transportation or transmission of electrical energy direct from the seller in one state to the consumer in another, for immediate or practically immediate use, subject only to a temporary stop enroute for the purpose of reducing the energy to a commercial voltage, remains "interstate commerce" until the commodity has reached its destination and unless theretofore sold to independent distributing companies in the latter state for resale to local customers. The court further held that the regulation of rates at which electrical energy transported from one state to another shall be sold is, so long as the rate fixed is not confiscatory or discriminatory against citizens of another state, a matter essentially local in its nature and not of such national importance as to require a general system and uniformity of regulation.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

SPRAY METHOD IS IMPORTANT FOR COOLING CONDENSER WATER.

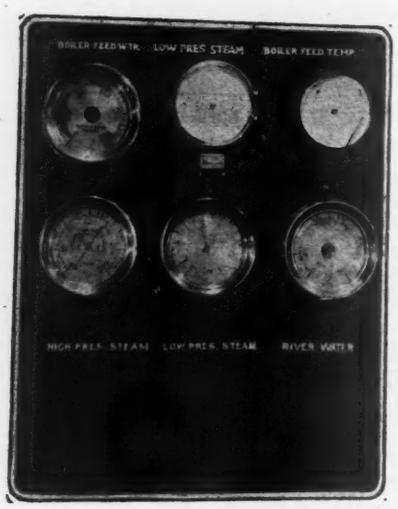
Improvements in condensers, vacuum pumps and other auxiliaries which make vacua as high as 29 ins. possible in commercial work have not brought as much attention to bear on spray cooling practice as might be expected. Spray cooling is a subject which is successfully handled only by careful attention to small details which often do not seem important to the layman. One of the common errors is the installation of the nozzles too large to produce a suitable spray.

Spray pond installations are not limited to localities where cool water is scarce. Many of the largest ponds in the country are on the shores of the Great Lakes and other large bodies of fresh water. This may be due to the high cost of installing suitable intakes, the high static pumping head or the difficulty of obtaining water free from suspended matter and scale forming impurities.

GAUGE BOARD FOR MOUNTING ALL INSTRUMENTS IN PUMP CELLAR.

Instruments Are Made More Useful by Assembling on Board in Pump Cellar of Power House.

The accompanying illustration shows a gauge board recently installed at the Phipps Power Station of the Duquesne Light Co., Pittsburgh, Pa. In the pump cellar at that station there were several gauges scattered around at various places.



Board Used for Assembling Instruments Together.

To help the pump man in his work, all of these gauges were assembled on one board and located in a place where they could be easily watched by the pump man.

According to the Duquesne Light Co. *News*, this gauge board was not made of wood, but of ⅛-in. sheet steel, was cut out to dimensions and the holes drilled for the gauges. The board was painted black and a white rim was added for the sake of appearance.

By assembling gauges in this manner the gauges become more useful, are easier to care for and the board may become an ornament in a place where ornamentation is too often overlooked.

MECHANICAL STOKERS REDUCE COST OF GENERATING POWER.

Cheaper Coal and Less Coal per Kw-Hr. Are Used With Mechanical Stokers Than With Hand-Fired Operation.

Mechanical stokers are shown to have decided advantages in the way of fuel economy over hand-fired grates in the data given herewith, representing the operating conditions in the plant of the Minneapolis Bedding Co., Minneapolis, Minn.

In 1917 this company installed a 250-kw., 2300-volt generator, direct-connected to a 20 in. by 21-in., 200-r.p.m., non-releasing Corliss engine. Two boilers that had previously been used for heating only were used to supply the steam, which was passed on to the heating system from the engine exhaust. The heating system was improved by the addition of a vacuum pump to keep the lines clear.

In January, 1918, while both boilers were hand fired, a recording watt-hour meter was installed and a month's records taken to determine actual operating fuel costs. During this month a total of 80.8 tons of coal, costing $6.69 per ton, was burned to generate 17,110 kw-hrs., at an average cost of $0.031 per kw-hr. for fuel.

In January, 1919, one of the boilers had been equipped with a mechanical stoker and a month's test was run with this stoker carrying part of the load and the hand-fired boiler carrying the remainder. During this month a total of 98.2 tons of coal, costing $6.28 per ton, was burned to generate 20,270 kw-hrs., at an average cost of $0.030 per kw-hr.

In January, 1920, both boilers were equipped with stokers and a third month's records were taken. It was found that 77.6 tons of coal, costing $5.19 per ton, was required to generate 23,285 kw-hrs., at an average cost of $0.017 per kw-hr.

In addition to the coal economy resulting from the use of stokers it was possible to reduce the working force required from five to three men. This in itself is no small economy. In fact, the scarcity of labor, aside from its cost, is often a serious handicap and any means of reducing the amount of labor required will, in a measure, tend to assure continuous operation.

The cheaper coal, burned by the stokers, is a

decided factor in the total cost reduction of the power generated. However, the coal burned was reduced from 9.5 lbs. to 6.7 lbs. per. kw-hr. by the change from hand-fired to mechanical stokers.

COATING BOILER BRICKWORK TO IMPROVE OPERATION.

Paint Applied to Exterior of Brickwork Reduces Air Leakage and Increases Draft, Thereby Effecting Economy.

The matter of reducing air infiltration through boiler settings by means of special preparations to be applied to the exterior surfaces of the settings has received wide attention. Various preparations, composed mostly of coal tar or asphaltum and asbestos, are manufactured for coating boiler settings. This material is applied usually with a trowel to a thickness of about ⅛ in., while the setting is warm but not hot. In order to be most effective, frequent inspections of the settings are necessary, pointing up cracks and renewing the coating where needed. For the average boiler setting, these coatings are effective, particularly if the setting is old or natural or induced draft is used. Some operators find an oil paint preferable, especially where the settings are in good condition and fairly new. In plants equipped with underfeed stokers and thick solid fire brick walls, the claim is made that no setting paint at all is necessary for reasons other than appearance or lighting effect. In preventing infiltration of air through boiler settings close attention must be given to keeping doors and other openings tight or considerable leakage may occur.

The value of setting paints or plasters can be readily determined in plants having CO_2 recording meters. Hand-operated instruments will show the same results, but require more effort on the part of the operator. The test will as a rule show 1 or 2% increase in CO_2 after the application of paint or dressing on a setting otherwise in good condition. Where doors and other openings are tight and the brickwork is only in fair condition, the application of dressing may increase the CO_2 by 5% or more, depending upon the condition of the setting. The reduction of air infiltration automatically increases the temperature of gases around the boiler tubes and in the stack. This increase in temperature passes more heat into the boiler, thus raising the efficiency of the furnace and increasing the stack draft. This results in greater capacity and efficiency in the furnace.

HIGH-TENSION INSULATORS TESTED WITH TELEPHONE RECEIVER.

Working Insulators Can Be Tested by Lineman With Simple Apparatus Which Gives Satisfactory Results.

The telephone-receiver test for defective insulators is a test that can be applied with the lines working and without the use of heavy or expensive apparatus. The test is made by shunting a portion of the current, leaking down the pole to ground, through a telephone receiver. The shunt connections are made, one through the lineman's spur and the other through a sharp prod. By connecting one terminal to his spur and sticking the prod carrying the second terminal into the pole higher up, the lineman is enabled to listen in and estimate the amount of leakage down the pole. With practice the lineman is able to pick, with a satisfactory degree of accuracy, the poles carrying defective insulators.

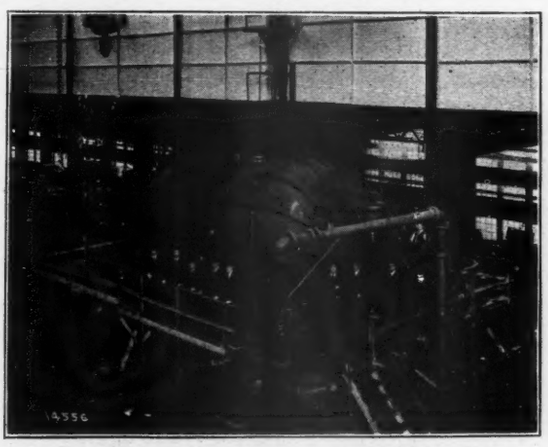
Although weather conditions have considerable effect on the indications given in this test, it has been found satisfactory on a number of distribution systems. The method is suitable for determining the degree of soundness of an insulator, and tests can be made at intervals on insulators showing weakness. A trained operator is able in many cases to follow the life of an insulator and have it removed after it has weakened to a definite point and before it actually fails in service.

It is sometimes necessary to make special tests to determine which is the weak insulator of several on the same pole. However, the receiver test applied to the various supporting arms will usually give the detail information without other trials. This test has other advantages aside from convenience and cheapness. It does not subject the insulator to abnormal or unusual strains and does not require the discontinuance or interruption of service.

CENTRAL STATION TO INSTALL A 60,000-KW. GENERATOR.

Large Generating Unit to Be Installed in Pittsburgh When Completed.

A 60,000-kw. steam-driven turbogenerator will soon be ready for operation in the plant of the Duquesne Light Co., Pittsburgh, Pa. The steam



New 60,000-kw. Turbine for Duquesne Light Co.

end of this machine, shown in the accompanying illustration, was officially "turned over" April 15 in the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Co., manufacturer of the unit.

Development of large machines like this unit serves to keep the operation of central stations of large capacity within the limits of control of a single operator. Very good steam economy is expected from this unit.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 475.—Pricing Motor Repair Work.—Can some of the readers through the questions and answers columns give me the best methods of pricing repair work on electric motors, armature winding, etc., and the best methods of setting the selling price of insulating materials and of magnet wire?—D. D., Indianapolis, Ind.

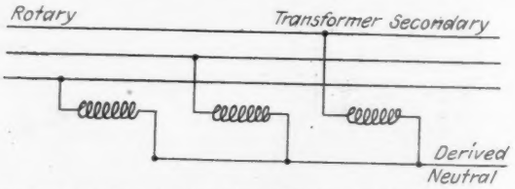
No. 488.—Voltage Drop in A-C. Circuit.—How can the voltage drop and power loss, resulting from running only one wire of an a-c. circuit through an iron conduit, be determined? How can the temperature rise in the wire and in the conduit be determined or estimated?—L. L. J., Chicago, Ill.

No. 489.—Advantages of Open and Closed-Delta Connections.—What advantage does the open-delta transformer connection have over the closed-delta connection? Under what conditions should each type be used? Is there any particular advantage in the use of the closed-delta connection aside from the fact that three transformers have greater capacity than two?—R. C. H., Hammond, Ind.

No. 490.—Lubrication of Slip Rings.—In the substation where I work there is a considerable amount of trouble experienced in preventing the copper-leaf brushes from cutting the collector rings on the a-c. side of the rotary converters. Will some one give me a formula for a good lubricant or the name of a prepared oil that will overcome this trouble?—J. A. R., Boston, Mass.

Answers.

No. 486.—Reactance to Obtain Derived Neutral.—The company I work for has a compound rotary converter rated at 300 kw., 250 volts, 1200 amperes, d-c.; three-phase, 60 cycles, and a 158-volt, 80-ampere, three-phase, 60-cycle reactance. As it is desirable to have a three-wire d-c. system instead of a two-wire system,



Proposed Method of Deriving Neutral for Neutral Three-Wire Circuit.

could this reactance be used in obtaining a derived neutral as illustrated? Would it take the place of the regular reactance between a rotary and its transformers?—L. S. K., Hammond, Ind.

Answer.—The reactance referred to should be satisfactory for use in deriving a neutral, provided the load on the three-wire d-c. system is kept well balanced. This reactance does not take the place of the regular reactance which is connected in series and carries the entire a-c. current supplied to the rotary converter. The balancing reactance is a Y-connected shunt. To insure an evenly divided d-c. voltage it is essential that the reactance be a three-phase reactance, having the magnetic circuits interlinked, and not three single-phase reactances on independent magnetic circuits.—H. S. R., Wahpeton, N. D.

No. 487.—Use of Asbestos Magnet Wire.—I have been told that asbestos magnet wire has some advantages over cotton and enamelled wire, especially in the repair of motors which are frequently overloaded. Can someone give me their experience with this kind of wire?—F. J. K., Cleveland, O.

Answer.—Asbestos-insulated magnet wire is the accepted standard for use in winding motor coils where there is excessive heat due to overload or other causes. Asbestos insulation has a heat coefficient in excess of the temperature required to melt the solder connections at the commutator.

The mechanical protection afforded by the asbestos insulation is considered a point in favor of asbestos-covered magnet wire when comparison is made with different kinds of textile-covered wire, the wearing quality of the asbestos being regarded as superior by many repairmen.

A motor which is designed for certain work can often be subjected to a much heavier load after rewinding with asbestos-covered magnet wire in place of cotton-covered magnet wire. In one instance recently where a piece of apparatus designed for No. 11 cotton-covered wire gave trouble from overload under certain operating conditions, the cotton-covered wire was replaced with No. 11 asbestos-covered magnet wire. This change was made without altering the design in any way, and resulted in the apparatus standing up under the overload.

Originally, asbestos-covered wire was used chiefly for repair work, while now a great many manufacturers are winding their new coils with it, the intention being to reduce repairs due to burnouts. Asbestos-covered wire is made in round, square and rectangular shapes with insulation equivalent to double cotton or heavier, if specified.—R. P. L., Chicago.

NEW RAILWAYS AND ELECTRICITY WORKS IN ENGLAND.

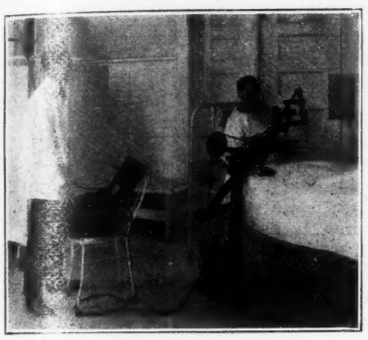
In connection with the various electric railway schemes which are planned for early execution in England, it was announced in London, March 8, that the Ministry of Transport had appointed an expert engineering committee to consider all such projects and report upon them as a whole. The schemes already practically decided upon will not actually proceed until the report is received. Lord Ashfield says that the London Underground Railways want to spend $30,000,000 upon extensions and improvements. This he describes as a "beginning," but when operations can commence cannot be stated until the financial position of the whole of the London transportation system has been determined. The word "beginning" was used by Lord Ashfield because he thinks that the whole traffic problem of London will have to be handled in a larger way than ever before. Entire new railways and some of them fast-speed services he notes as being essential. The present problem is how to raise that necessary thirty million dollars, for until the position is improved by the institution of higher fares, a public issue of capital could not be successful.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

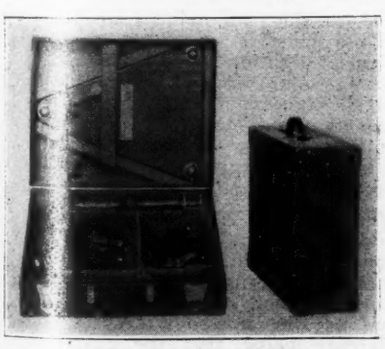
Portable X-Ray Outfit.

The X-ray is the invaluable ally of surgery and medicine, but until recently it has been necessary to transport the patient to the X-ray laboratory. Those sufferers whose condition forbade this, were, through no fault or desire of their own, deprived of the X-ray's benefits, with the result that medical skill has been handicapped in diagnosis work. Dr. W. D. Coolidge and his associates in the research laboratory of the General Electric Co., Schenectady, N. Y., have recently perfected a portable X-ray outfit which meets this need. The U. S. Army portable outfit rendered service of a high order in the European war, and the new and more compact outfit is the peace outgrowth of the army set.



Portable X-Ray Outfit in Use.

It is now possible for a doctor to transport the entire new outfit, packed in four hand-borne units, to any home wired for electricity and produce radiographic results comparable with those secured in a completely equipped X-ray laboratory. The process of operating the machine is simplified for him by control systems enabling him to use the exact ray intensity he needs and a time switch that accurately controls the length of each exposure. Plates can thus be produced which show remarkable uniformity. An ordinary lamp circuit will supply the necessary current.



Case with Portable X-Ray Outfit Packed for Transportation.

The portable Coolidge X-ray outfit is made also for hospital use, so that it can be taken to the bedside of patients who cannot be conveniently moved to the X-ray laboratory. The results produced with this outfit are comparable with those of any ordinary X-ray machine except its power is too low for instantaneous gastro-intestinal radiography which requires greater speed and power.

The portable Coolidge set has been compacted and simplified over the army type. The bulb itself has been reduced in size to 2.5 ins. By making the tube of thick lead glass, thus replacing a heavy lead shield, the total weight of the tube and its protection was reduced 5 lbs., with a consequent lightening of the frame which supports it. This lead glass contains about 57% metallic lead and in its resistance to X-rays is equal in protective power to lead 0.0625 in. thick.

The new tube rectifies its own current, thus doing away with a heavy, bulky rectifier and adding to the efficiency of the set as a whole. The transformer, which is the heaviest unit of the outfit, weighs 43 lbs. with its case. A minimum of weight and bulk is secured in the other parts of the outfit by a careful choice of materials, sizes and shapes.

Variation in circuits is overcome by the control system of the outfit by means of which it is possible always to deliver the same definite voltage to the transformer primary.

Small Oscillating Fan with Adjustable Base.

The Emerson Electric Manufacturing Co., St. Louis, Mo., has perfected a 9-in. oscillating fan with an adjustable base. The fan may be mounted on the wall or in any position suitable for the larger types of fans.

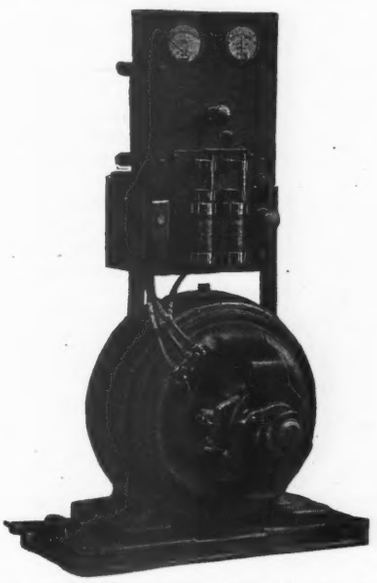
Generators and Panels for Farm Light and Power Service.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has placed on the market a line of electric generators and control panels, for use with internal-combustion engines, for farm light and power service. These units are made in standard capacities from 0.5 to 2 kw. and are adapted for operation with 32-volt battery equipment.

The generators are built to be either direct connected or belt driven. They are shunt wound for normal operation, but have an additional series winding which allows the generator to be operated as a compound motor for cranking the engine.

The control panel is made of sheet steel and is mounted directly on the generator, as shown in the accompanying illustration. On the panel are a voltmeter, ammeter, rheostat, line switch, line fuses, series field (starting) switch, ignition (stopping) switch and a reverse-current relay.

To start the unit the series field (starting) button, at the lower right side of the panel, is pushed in, causing the battery to operate the generator as a motor to crank the engine. To stop the unit, the switch at the lower left of the panel is pushed in, breaking the ignition circuit of the engine. The rheostat controls the battery voltage, and the double-pole fused switch in the center of the panel is used to connect the electric generating unit with the light and power line. The relay mounted on the rear of the panel automatically keeps the battery from discharging through the generator when the generator is not running. It also automatically connects the generator to the battery when the generator voltage is sufficiently high to charge the battery.



Non-Automatic Generating Unit for Farm Lighting Outfit.

An automatic stop is supplied with these panels when desired. The stop can be adjusted to cut the engine ignition circuit when the battery has been fully charged.

Small Electric Incubator.

The National Incubator Co., Racine, Wis., have recently put on the market an electric incubator, especially designed for city or suburban poultry raisers. It has a capacity of 75 eggs and is heated by two electric light globes placed in the top compartment. Between these globes and the egg chamber is a steel plate which retains and distributes the heat. A thermostat regulates the temperature at 103 deg. F.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Delta-Star Electric Co., Chicago, is issuing special publication No. 92 describing a few forms of its unit type high-tension outdoor substations.

Edison Electric Appliance Co., Ontario, Cal., has completed plans for the construction of a new 1-story addition to its plant, to cost about $16,000.

John E. Frechie & Co., Inc., 634 Arch street, Philadelphia, Pa., lighting fixture dealers, is removing to the 5-story building at 27 North Seventh street.

General Electric Co., Schnectady, N. Y., will build a porcelain manufacturing plant at Pittsfield, Mass., in connection with its existing works, utilizing local clay in this product.

Bryan Marsh Division, National Lamps Works of General Electric Co., Schenectady, N. Y., has moved its Chicago offices into new and larger quarters at 623 South Wabash avenue.

Albert Schieble, patent attorney, Chicago, has moved his offices to the Westminster building, 110 South Dearborn street, where he occupies suite 1200.

Getz Power Washer Co., Morton, Ill., has issued a pamphlet describing the "Getz" electric and power washing machines, the machines being built for both electrical and gasoline engine operation.

Apex Appliance Co., 1723 Broadway, Oakland, Cal., manufacturer of electrically operated washing machines, etc., will build a new 1-story reinforced concrete plant, to cost about $60,000.

Union Electric Co., Waterbury, Conn., has filed notice of organization to operate at 33 Phoenix avenue for the production of electrical goods. Morris Joseph and David Goldman head the company.

Dayton-Dowd Co., Quincy, Ill., is sending out bulletins Nos. 240, 241 and 242, giving details of the various types of centrifugal pumps manufactured by the company, together with other matters of interest to power-plant engineers.

J. G. White Engineering Corp., New York City, has been awarded a "Certificate of Appreciation" by the U. S. War Department for services rendered by the corporation during the world war.

Standard Electric Time Co., Waterbury, Conn., manufacturer of electrically operated time clocks, has filed notice of an increase in its capital stock from $100,000 to $200,000, for general business expansion.

Electric Storage Battery Co., Philadelphia, Pa., after occupying quarters at 100 Broadway, New York City, for approximately a quarter of a century as its New York office, will move on April 26 to the National Association building, 23 West 43rd street, where larger offices have been obtained.

Johnson Electric Washer Co., Oakland, Cal., has had plans prepared for the construction of a new 1-story plant at 40th and Adeline streets. The structure will be about 120 by 135 ft., and is estimated to cost $40,000.

Philadelphia Storage Battery Co., Ontario and C streets, Philadelphia, Pa., has awarded a contract for the erection of a new 2-story and basement brick plant addition. The structure is estimated to cost about $40,000.

Baltimore Electrical Supply Co., 309 North Calvert street, Baltimore, Md., has awarded a contract for the construction of a new building at 331 North Calvert street, about 69 by 100 ft. The structure is estimated to cost $70,000.

Phillips Insulated Wire Co., Pawtucket, R. I., has completed arrangements for the construction of a new 1-story brick addition to its plant on Winthrop avenue. The structure will be about 45 by 81 ft. and is estimated to cost $13,000.

Charles Cory & Son, 209 Hudson street, New York City, manufacturers of electrical goods, including signaling and alarm systems of various types, have filed articles of incorporation under Delaware laws with capital of $1,850,000.

L. B. Stillwell & H. S. Putnam, consulting engineers, and the **L. B. Stillwell Engineering Corp.,** construction engineer, now at 100 Broadway, announces the removal of headquarters to 143 Liberty street, New York City.

Farrar & Trefts, Perry and Illinois streets, Buffalo, N. Y., electrical and steam engineering establishment, have filed notice of an increase in their capitalization from $400,000 to $2,000,000, to provide for general business expansion.

Illinois Electric Porcelain Co., Macomb, Ill., manufacturer of electrical porcelain insulations, has issued a new catalog giving prices on its products, together with illustrations of the various types of insulators made by the company.

Sprague Electric Works of General Electric Co., 527 West 34th street, New York City, is sending to the trade a neat folder called "Summer Comfort," in which the advantages claimed for the Sprague a-c. and d-c. electric fans are told.

Lakewood Engineering Co., Cleveland, O., has awarded a prize of $1,000 to Clarence I. McNair, Jr., Cloquet, Minn., for the best treatise on industrial haulage in which Lakewood tier-lift trucks were used.

American Steam Conveyor Corp., 326 West Madison street, Chicago, Ill., is sending out a blotter containing descriptive matter relative to an air-tight ash pit door that has been developed by the company.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is sending to the trade booklet H, a 4-page leaflet describing and illustrating C-H soldering irons and associated equipment, including the C-H automatic rack, C-H soldering fixture and the C-H current regulator for temperature control.

Ivanhoe-Regent Works of General Electric Co., Cleveland, O., is sending out price lists for schedules E and ER covering "Ivanhoe" glass units and "Ivanhoe Druid and Sudan" pressed reflectors, and also discount lists in connection with the same schedules as well as leaflets covering new prices on other "Ivanhoe" products.

Lincoln Products Corp., 320 Market street, Newark, N. J., has recently been formed to market power-transmission equipment. The new corporation will carry a stock of power-transmission specialties. T. P. Cunningham, formerly sales manager, transmission department, Hyatt Roller Bearings Co., Harrison, N. J., is president of the corporation.

The Kentucky-West Virginia Engineering and Electric Co., Ashland, Ky., has been organized to do general engineering and construction business, and to engage in the retail sales of electrical supplies. Thompson B. Pierce, Bluefield, W. Va., is president, C. L. Biddison, War Eagle, W. Va., vice-president, and R. F. Carpenter, Ashland, Ky., secretary and treasurer.

Benjamin Electric Manufacturing Co., Chicago, has issued a catalog No. 22, which, following a page of general information as to "Benjamin" products, contains loose-leaf pages devoted to the following schedules: wireless clusters and pipe clusters, industrial lighting equipment, wiring devices, fixture and fixture parts, industrial signals; panelboards, and a complete index covering all items mentioned in the catalog. The catalog is in binder form with room to insert schedules to be issued later.

H. S. B. W.-Cochrane Corp., Philadelphia, Pa., formerly the **Harrison Safety Boiler Works,** has issued a booklet describing the hot process water softener, a modern development of the lime-soda process, the difference being that the chemicals are added to the water only after it has been heated to 205° F., or higher, which results in practically instantaneous and complete chemical reactions and in more rapid settlement of the precipitate. The above and other claims for the process are fully set forth in the booklet.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

H. A. PRICE, formerly of Talladega, Ala., is now manager of the Texas Power & Light Co. plant at Gainesville, Tex.

A. D. MACKIE, general manager of the Springfield Consolidated Railway Co., Springfield, Ill., has been elected president of the Sangamo Club of that city.

K. M. JENNINGS is now manager of the Douglas County Light & Water Co., Roseburg, Ore. Mr. Jennings was formerly connected with a Portland (Ore.) public utility company.

C. THAYER is now superintendent of the Carolina Light & Power Co. at Henderson, N. C., having been transferred to that point from the Oxford, N. C., station of the company.

B. N. FREEMAN, New York City, has been elected a director of the Cities Service Co., 60 Wall street, New York City. Mr. Freeman is manager of the bond department of the company.

H. G. HARVEY has resigned as commercial engineer of the Nassau Light & Power Co., Mineola, N. Y., to take up similar work with the Pennsylvania Utilities Co., Easton, Pa.

EDWARD J. GLENNAN, a member of the Public Utilities Board of New York City, was recently appointed to the Supreme Court Bench of New York State by Gov. Alfred E. Smith.

W. W. MARSHALL, superintendent of the Hydro-Electric Power Commission at Orangeville, Ont., has been appointed town engineer of Orangeville. He will continue as superintendent of the commission.

LON J. GEER has been elected vice-president and general manager of the West Texas Electric Co., Sweetwater, Tex. He was formerly manager of the Gainesville (Tex.) plant of the Texas Power & Light Co.

SCHUYLER R. FORD, formerly chief gunner, U. S. N., and an executive officer at the Sayville, N. Y., radio station, has been appointed engineer in charge of the high-power radio station at New Brunswick, N. J.

CHARLES H. COLBY has resigned his position as operating superintendent of the Hydro Electric Commission of Ontario, at London, Ont., and has entered the services of the St. Cloud Public Service Co., St. Cloud, Minn., as superintendent.

M. T. CRAWFORD, superintendent of distribution of the Puget Sound Power & Light Co., Seattle, Wash., has returned to that city following an eastern trip in which he made inspections of underground distribution systems in various cities.

MINOR CORMAN, for 11 years associated with the Central Home Telephone & Telegraph Co., Louisville, Ky., has severed his connection with that company, and, together with L. C. Griffiths and H. H. Carter, Seymour, Ind., has purchased a controlling interest in the Shelby County Telephone Co., Shelbyville, Ky.

W. J. CANADA, formerly electrical engineer of the United States Bureau of Standards, and more recently in the engineering department of Stone & Webster, Boston, Mass., has been appointed engineering expert of the National Electric Light Association, and

W. J. Canada.

will be located at the New York City headquarters. Mr. Canada has been active in electrical and allied industries for many years. After graduating from the Sheffield Scientific School of Yale University in 1902 he entered the testing department of the General Electric Co. at Schenectady, N. Y., and later was connected with the Appleyard Electrical Interurban Lines of Ohio, the Ohio Inspection Bureau, Standard Oil Co. and the Rocky Mountain Underwriters' Association. He has written extensively for ELECTRICAL REVIEW and other electrical journals.

JAMES T. HUTCHINGS, who retired on April 1 as president of the Rochester Gas & Electric Corp. to become assistant general manager of the United Gas Improvement Co. of Philadelphia, was tendered a dinner by employes of the Rochester company shortly before his departure, at which he was presented with a book signed by every employe of the company and a gold watch.

WILLIAM N. KEISER has been appointed manager of the general construction department of the Lakewood Engineering Co., Cleveland, O. He is a graduate of the electrical course at Purdue University, and for several years was with the General Electric Co., Schenectady, N. Y., engaged in building power houses and underground wiring systems.

ROBERT TEN EYCK LOZIER, former associate of Thomas A. Edison, now engaged in engineering activities in New York City, is soon to wed Miss Lucille Scheffler, daughter of Mr. and Mrs. Frederick Scheffler, of Glen Ridge, N. J., and Northport, L. I. Mr. Scheffler, like Mr. Lozier, was formerly associated with Mr. Edison, and is now with the Fuller Engineering Co., of Allentown, Pa., and New York City.

MAJ. R. C. HAVEN, ordnance department, U. S. A., has been appointed secretary of the Minneapolis council of the National Safety Council. Before being commissioned by the War Department Major Haven was for several years connected with the Pittsburgh office of the Ford Motor Co. Previous to that he had been with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. During the war he supervised the expenditures of companies which manufactured millions of dollars of ordnance at Peoria, Ill., Detroit, Mich., and St. Louis, Mo.

A. L. KEMPSTER, who for several years prior to the purchase by the city of Seattle of the street railway lines of the Puget Sound Traction Light & Power Co., was manager of these lines, has been named general manager of the lines of the New Orleans Railway & Light Co. Mr. Kempster entered street railway work November 10, 1891, as an office boy with the Consolidated Street Railways of Seattle. He became an accountant, then auditor and secretary. When the Seattle Electric Co. was organized in 1899, he entered the operating department as trainmaster of the system, going from there to superintendent of transportation, then to general superintendent, and finally becoming manager.

MAURICE LEGORI, for the past two years manager in Argentina for Viele, Blackwell & Buck, New York City, has been made manager of a foreign department newly created by Ray D. Lillibridge, Inc., 111 Broadway, New York City. The department is to give advice in the matter of export advertising and sales. Mr. Legori was recently manager of export sales of the Wagner Electric Manufacturing Co. He is a graduate in electrical engineering of the Escola de Engenharia de Porto Alegre in Brazil, and he took post graduate work in the Technische Hochschule in Charlottenburg, Germany. He spent two years in Europe, part of the time associated with the Allgemeine Elektricitäts Gesellschaft in Berlin.

OBITUARY.

J. R. RICHARDSON, for 26 years connected with the Bell Telephone Co., in Winnipeg, Man., died recently at the age of 59 years.

ALBERT C. ROSECRANZ, president of the Vulcan Plow Co., died at his home, Evansville, Ind., April 20. He was 78 years old.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES

Ashland, Mass.—Dr. Sweet's Root Beer, Inc., 10 Post Office square, Boston, has taken bids for the construction of a manufacturing works and power plant, 3-story, about 65 by 65 ft., estimated to cost $50,000. McNaughton & Robinson, 101 Tremont street, Boston, are architects for the company.

Boston, Mass.—Unit Laundry Co., 8 Island street, Roxbury district, has inaugurated work on the construction of a new 1-story laundry plant at 32 Parkman street. The structure will include a 1-story boiler plant for general factory service, and is estimated to cost about $20,000.

Providence, R. I.—Atlantic Refining Co. has had plans prepared for the erection of a new brick and concrete boiler plant addition to its works, about 28 by 35 ft., for increased power facilities.

Providence, R. I.—Abraham White is having plans prepared for the erection of a new addition to the 3-story brick structure recently acquired on Hospital street at Borden street, the new extension to be used as a boiler plant for general factory service.

Buffalo, N. Y. — Buffalo General Electric Co. has filed notice of an increase in its capital from $10,000,000 to $25,000,000, to provide for general business expansion.

Geneva, N. Y. — Notice has been filed by the Empire Gas & Electric Co., 97 Castle street, of an increase in its capitalization from $1,250,000 to $4,000,000, to provide for proposed expansion.

Geneva, N. Y.—Empire Gas & Electric Co., 97 Castle street, has awarded a contract for the installation of a new waterworks and gas manufacturing plant, for increased operations. This project is estimated to cost about $200,000.

Lockport, N. Y.—Lockport Light, Heat & Power Co., has filed application with the Public Service Commission for permission to increase its rates for gas service.

New York, N. Y.—New York Telephone Co., 15 Dey street, has completed negotiations for the purchase of property comprising four 4-story buildings, about 100 by 400 ft., at 150 East 98th street between Lexington and Third avenue, for a consideration of about $200,000. It is said that the company plans to utilize the site for a new exchange plant. The company has filed plans for the construction of a new addition to its building at Irving place and 18th street, to cost $80,000.

New York, N. Y.—New York Edison Co., Irving place and 15th street, is understood to be planning for the construction of a 1-story reinforced concrete and steel substation on Cedar street. The structure, including equipment, is estimated to cost about $75,000. W. Whitehill, 12 Elm street, is architect and engineer.

Olean, N. Y.—The board of managers of St. Bonaventure college, Allegheny, N. Y., is having plans prepared for the installation of a new central-heating plant at the institution, estimated to cost about $45,000.

Potsdam, N. Y. — St. Lawrence Transmission Co. has filed application with the Public Service Commission, Albany, for permission to extend its transmission lines to the town of Russell, St. Lawrence county, as well as for approval of a franchise granted for operation in this district.

Egg Harbor City, N. J.—Egg Harbor City Telephone Co. has been granted permission by the State Board of Public Utility Commissioners to increase its rates for service from $15 to $21 a year for party lines, and from $27 to $33 for direct lines, the entire increase to be subject to the installation of a 24-hour service.

Newark, N. J.—Basch & Greenfield Co., 67 Seventh avenue, has awarded a contract to Edward M. Waldron, Inc., 665 Broad street, for alterations and improvements in its engine and boiler plant at Summer avenue and Seventh streets, to facilitate operations. The work is estimated to cost about $15,000.

Newark, N. J.—American Hair Felt Co., 139 Lockwood street, has had plans prepared for the construction of a new 1-story brick boiler and engine plant addition at its works, estimated to cost about $20,000.

Paterson, N. J.—A new boiler plant will be erected by the Empire Silk Co. on Ninth avenue at 22nd street, for power facilities in connection with the construction of a proposed new silk mill at this location.

Rockaway, N. J. — The borough council is making rapid progress on the installation of a new electric street-lighting system in Main street, to be of arc light type, with new incandescent lighting units used in the annexed district of the municipality.

Trenton, N. J. — Blabely Laundry Co., 11 South Warren street, has completed excavations in connection with the proposed 1-story laundry plant, about 85 by 180 ft., to be located at Brunswick and North Montgomery avenues. The new works are estimated to cost about $100,000, and considerable electrical laundry equipment, etc., will be required, it is understood. The Newton A. K. Bugbee Co., 206 East Hanover street, has the building contract.

Erie, Pa.—Skinner Engine Co., 12th and Chestnut streets, has awarded a contract for the construction of the proposed addition to its plant and alterations in the existing works, for increased operations. The work will comprise the erection of two manufacturing buildings, shop building and power plant for factory service, and is estimated to cost about $80,000.

Philadelphia, Pa.—Arrangements are being made by the city for the completion of the superstructure of the Frankford elevated line before the end of the present year. This work will complete the first operating section of the Frankford elevated from Front and Arch streets to Bridge street, Frankford district, and is estimated to cost in excess of $1,500,000.

Philadelphia, Pa.—Charles Lennig & Co., 112 South Front street, have completed arrangements for alterations and improvements in their boiler plant at Richmond and Kennedy streets.

Philadelphia, Pa.—Rockford Knitting Co., Randolph and Jefferson streets, has awarded a contract for alterations and improvements in the power plant at its works.

Philadelphia, Pa.—William Cramp & Sons Ship & Engine Building Co., Richmond and Norris streets, has been awarded a contract by the Hydro-Electric Power Commission of Ontario, for three 55,000-hp. turbines, to be installed in connection with the Niagara Falls waterpower development. This is said to be the largest contract for hydroelectric equipment ever placed.

Philadelphia, Pa. — Philadelphia Electric Co., 10th and Chestnut streets, has completed negotiations for the purchase of a 3-story building at the corner of 18th street and Columbia avenue, about 20 by 76 ft., for a consideration of about $16,000.

Philadelphia, Pa. — The board of managers of the State Home for Feeble Minded Women has had plans prepared for the construction of a new 1-story laundry building at the institution at Glen Iron station, about 30 by 80 ft. Electrical laundry equipment, etc., will be required, it is understood. Dr. J. M. Murdock is in charge of the work.

York, Pa.—York Railways Co. is having plans arranged for extensive improvements in its traction system. The work will include the installation of automatic substations at Martins, and in the vicinity of Gitts Run; the installation of additional transformer equipment at the York power plant; changing of the trolley voltage between Smysers and Hanover from 6600-volt alternating to 600-volt direct current, rebuilding of overhead trolley between the above points, and the purchase of a quantity of new rolling stock.

Baltimore, Md.—Consolidated Gas, Electric Light & Power Co. has filed

plans for the erection of a new building at Kloman street and the Western Maryland railroad, about 34 by 70 ft., estimated to cost $46,000.

Hagerstown, Md.—The city council is understood to be arranging plans for the installation of new extensions to the electric street-lighting system, of "white way" type, throughout various thoroughfares.

Frederick, Md. — Hagerstown & Frederick Railway Co. is having plans prepared for a new high-tension transmission line connecting this city with the company's hydraulic and steam stations in West Virginia. The new line will be of 33,000-volt capacity, and is estimated to cost about $60,000.

Elm City, N. C.—The town council has taken bids for the construction of a new transmission system extending to Wilson, N. C., a distance of approximately 6 miles. J. W. Winstead is mayor.

NORTH CENTRAL STATES

Dayton, O.—H. Gerstner & Sons, manufacturers of tools, etc., are planning the erection of a 3-story addition to their plant, 40 by 80 ft., at an estimated cost of $25,000.

St. Bernard, O. — Elmwood Casting Co. is having plans prepared by the Frank D. Chase Co., 122 South Michigan avenue, Chicago, for the rebuilding of its plant, recently destroyed by fire. The new works is estimated to cost $200,000.

Toledo, O. — Joseph L. Skeldon Machinery Co. has been awarded the contract for erecting a new steam plant for the Dover (O.) municipal light and power plant.

Indianapolis, Ind.—Craig Hunt Motors Co., 9 North Illinois street, is having plans prepared for a new plant to cost about $300,000, including equipment.

Kokomo, Ind.—Haynes Automobile Co. will erect a factory building for the manufacture of the small Haynes cars.

Washington, Ind.—The city will vote on May 8 on the question of issuing $105,000 bonds for the building of an electric light plant.

Chicago, Ill.—Bell & Howell Co., 1907 Larchmont avenue, manufacturer of motion-picture machinery, is receiving bids for a 3-story addition to its plant, 50 by 105 ft., to cost $50,000.

Lincoln, Ill. — Lincoln Water & Light Co. will expend $6000 in the installation of a new turbogenerator.

Marion, Ill.—The town council has under consideration the establishment of a "white way."

Princeton, Ill. — A committee has been appointed to secure better street lighting for the city. H. H. Priestley is chairman of the committee.

Clark Lake, Mich.—Liberty Hydro Electric Co. will generate and distribute electric light and power to the villages and farms of Hillsdale and Lenawee counties.

Detroit, Mich. — Superior Machine & Engineering Co. has taken bids for a 3-story plant, 100 by 200 ft., at East Larned street and St. Aubin avenue. The new plant is estimated to cost $100,000.

Lansing, Mich.—Alword & Burdick, Hartford building, Chicago, have prepared plans for a $1,000,000 electric light plant for the city. Guy D. Crane is city manager.

Port Huron, Mich.—The city electric light plant will extend its transmission lines on Water street. C. L. Boynton is city commissioner.

Eagle River, Wis.—The town board is planning to establish an electric light and power plant. Frank W. Carter is town clerk.

New Ulm, Minn.—The city will receive bids for the furnishing and complete installation of power plant equipment for the municipal power plant. For information address A. J. Mueller, superintendent of electric light and water department.

St. Louis, Mo. — Union Electric Light & Power Co. has purchased a site on Lewis street and plans to erect a new power unit.

Milford, Kan.—The Milford Chamber of Commerce would like to get parties financially interested in an electric lighting, power, waterworks and ice plant it is proposed to erect in the city at an estimated cost of $250,000. Parties desiring further information are requested to write Charles Say, corresponding secretary, Chamber of Commerce, Milford, Kan.

SOUTH CENTRAL STATES

Mulga, Ala.—Woodward Iron Co. is understood to be considering plans for the installation of electrical equipment for a new lighting plant. W. Blocker is electrical engineer for the company.

Columbia, La.—The town council has approved a bond issue of $30,000, the proceeds to be used to cover the cost of the installation of a new electric light and waterworks plant.

Heber Springs, Ark. — Heber Springs Light Co., recently incorporated with a capital of $25,000 has perfected organization, and plans are being arranged for the construction of a new plant to be located on a site to replace an electric plant recently destroyed by fire with loss estimated at about $10,000.

Claremore, Okla.—The city council has voted bonds for $75,000, the proceeds to be used for improvements and extensions in the municipal light and water systems.

Kingfisher, Okla.—The city will install a 500-kw. turbogenerator. E. Fisher is superintendent of the electric light plant.

Columbus, Tex. — Columbus Electric Light Co. is arranging plans for enlargements at its plant for increased operations. The work will include the construction of a new transmission line to Giddings, about 3 miles.

Dallas, Tex.—The city has had plans prepared for the installation of a new ornamental electric street lighting system on North Harwood street, to cost about $25,000. George D. Fairtrace is the city engineer.

Denison, Tex.—In connection with the issuance of bonds for $244,000 for municipal improvements, plans are being prepared by the city for the installation of a new electric lighting system. Electrical pumping equipment for waterworks service will also be installed.

Liberty, Tex.—Liberty Light & Power Co., recently incorporated with a capital of $15,000, is planning for the construction of an electric plant for local service. A. J. Rivierre heads the company.

Newcastle, Tex —Newcastle Light, Power & Ice Co. is understood to be arranging plans for the immediate installation of a new electric light, power and ice manufacturing plant, to cost about $50,000.

WESTERN STATES

Salem, Ore.—Enterprise Electric Co. has had plans prepared for the construction of a new hydroelectric power plant estimated to cost about $150,000. The works will be located on the Wallowa River, and application for the use of water has been filed with the state officials.

Vale, Ore.—J. Edwin Johnson, of this place, has filed with the state engineer an application for permit to appropriate 100 sec. ft. of water from the middle fork of the Malheur river, to be used in developing water power. The diversion works will include a concrete dam 5-ft. high, 60-ft. long at the top and 40-ft. at the bottom, with waterway and concrete headgate. Water will be delivered from the forebay to the power house through two penstocks. Power will be generated by turbine water wheels and will be used in pumping water for irrigation in Harney Valley and for municipal purposes. Plans provide that work begin one year from date of permit. The estimated cost is $350,000.

Seattle, Wash. — Central Sand & Gravel Co., located about 3 miles from Seattle, has recently completed the electrification of its entire plant.

Yakima, Wash.—Plans are being arranged by the Pacific Power & Light Co. for extensions and improvements in its local plant, to facilitate operations. The work is estimated to cost about $30,000.

Inglewood, Cal.—Plans have been completed by the local officials for the installation of new pumping equipment at the municipal waterworks plant. It is also proposed to install a new booster pump. Olmsted & Gillelen, Hollingsworth building, Los Angeles, are the consulting engineers.

Lakeport, Cal. — Snow Mountain Water & Power Co. is planning for extensions and improvements in its plant and system to increase the capacity in the neighborhood of 25%. It is proposed to issue stock for $1.-500,000, the proceeds to be used for this improvement work, which will include the construction of a new dam at the Gravelly dam site. The company has been granted permission to issue this stock by the State Railroad Commission.

Long Beach, Cal.—City is having plans prepared for the immediate installation of a new electric street lighting system, ornamental type, on

Fourth street, between Pine and Alamitos streets. The work is estimated to cost $18,000.

Richmond, Cal. — The Western States Gas & Electric Co. has closed a contract for over 300 hp. in motors for the California Wine Association A Richmond filtration plant, which recently contracted for 200 hp., has applied to the company for 300 or 400 additional hp.

San Bernardino, Cal.—In connection with the construction of a new plant addition by the Hanford Iron Works, estimated to cost in excess of $50,000, considerable electrical equipment will be required. The company's plans include the installation of a new 5-ton electric traveling crane, as well as new electric furnace equipment. W. J. Hanford heads the company.

San Bernardino, Cal. — The city council has had plans prepared for the installation of a new ornamental type electric street-lighting system on Third street, between Arrowhead and Vernon avenues.

San Diego, Cal.—The city council is considering plans for the establishment of a new pumping plant in the vicinity of La Jolla. Electrically operated pumping units will be installed in the structure, the work being estimated to cost about $52,000.

San Francisco, Cal.—The Turlock and Modesto Irrigation Districts have voted a total of about $6,000,000 for the construction of a dam and reservoir for power and irrigation purposes.

Vallejo, Cal.—Pacific Gas & Electric Co. has completed arrangements for the construction of a new administration building on Virginia street. It is planned to inaugurate active construction at an early date.

Glendale, Ariz.—The town has voted $20,000 in bonds for the purpose of establishing an electric light and power plant. H. G. Sparrow is the town clerk.

CANADA

Lakefield, Ont.—Fire recently destroyed a portion of the power plant of the Lakefield Power Co., with loss estimated at about $7000. It is understood that the company is planning immediate rebuilding.

London, Ont.—The erection of a factory at London for the manufacture of equipment is said to be under consideration by the Hydro Electric Power Commission of Ontario.

Fredericton, N. B.—It is reported that the International Paper Co. has decided not to proceed with its power development at Great Falls, owing to the high cost of labor and materials.

Halifax, N. S.—The Nova Scotia Power Commission has been authorized to proceed with the development of an 8000-hp. unit at Margaret's Bay, about 20 miles from Halifax. K. H. Smith is the engineer in charge of the work.

INCORPORATIONS

New York, N. Y.—Renew Electric Lamp Corp. Capital stock $100,000. To manufacture electric lamps, etc. Incorporators: M. V. Ryan, C. M. Stuart, Jr., and J. R. Moynihan, 408 West 150th street.

New York, N. Y.—Carmichael 8-in-1 Fuse Plug Corp. Capital stock $100,000. To manufacture fuses, plugs, etc. Incorporators: E. and H. Carmichael, and S. E. Haupt, 201 E. 115th street.

Brooklyn, N. Y.—Thresher Manufacturing Co. Capital stock $250,000. To manufacture electrical appliances, etc. Incorporators: G. C. Evans, and W. K., and J. D. Smith, 25 Claremont avenue.

New York, N. Y.—Republic Machine & Motor Co. Capital $6000. To manufacture motors, machinery, etc. Incorporators: G. Ollendorf, I. M Sakin, and J. Newman, 23 East 15th street.

Brooklyn, N. Y.—E. R. Wengenroth. Capital stock $5,000. To operate a general electrical contracting establishment. Incorporators: G. Alexander, Jr., E. R. and W. D. Wengenroth, 317 East 29th street.

Newark, N. J.—Newark Art Lamp Mfg. Co. Capital, $100,000. To manufacture lamps, etc. Incorporators: Emil and Irwin Lindner and Zigmund Gzoski.

Newark, N. J.—New Jersey Lamp Works. Capital, $125,000. To manufacture electric lamps, etc. Incorporators: Ascher Herman and Maurice S. Maurer.

Passaic, N. J.—U. S. Battery Co., Inc. Capital, $200,000. To manufacture electric batteries. Incorporators: Joseph J. Flood, Aaron L. Simon and M. R. Simon.

Plainfield, N. J.—Harris-MacIntosh Co. Capital, $5,000. To manufacture electric batteries. Incorporators: J. A. Davie, A. C. MacIntosh and G. B. Harris.

Newark, N. J.—Blau Service, Inc. Capital, $125,000. To manufacture electrical appliances, etc. Incorporators: Edward and L. Blau and Ellis J. Cook.

Pittsburgh, Pa.—International Electric Co. Capital, $100,000. To manufacture electrical supplies. Incorporators: J. A. Hulings, Waynesburg; Jarold Jackson and W. L. Jordan, Pittsburgh.

Wilmington, Del.—Hoch Brothers. Capital, $25,000. To operate a plant for the manufacture and repair of motors. Incorporators: M. Davis, and Harry M. and Charles I. Hoch.

Fort Wayne, Ind.—The Kruse Electric Co. has been organized to deal in electrical merchandise with capital stock of $75,000. Those interested are F. G. Kruse, C. W. Tracht and C. P. Squires.

Liberty, Tex.—The Liberty Light and Power Co. has been incorporated with a capital stock of $15,000. The incorporators are A. J. Riviere, B. G. Riviere and E. B. Pickett, Jr.

Charleston, W. Va.—Gauley Oil, Gas & Power Co. Capital, $200,000. To operate a local electric light and gas plant. Incorporators: J. B. Chapman, Paul B. Grosscup, Charleston, and Dyer McClung, Ansted, W. Va.

Leighton, Ia.—The Leighton Electric Co. has been incorporated with capital stock of $10,000 to supply light and power for the town of Leighton, Address John R. Brower, Leighton, Ia.

Lafayette, Ind. — The Lafayette Service Co. has been incorporated with capital stock of $10,000. The incorporators are F. H. Cutshall, J. H. Barrett, Jr., and Harry Williams, Jr.

Punxsutawney, Pa.—Haese Electric Co. Capital stock, $25,000. To manufacture electrical goods. M. Haese is named as the principal incorporator.

Jackson, Miss. — Jackson Public Service Co. has been incorporated with capital stock of $600,000. Joseph H. Brewer, Charles McPherson and others are incorporators.

Perryton, Tex. — Perryton Public Utilities Co. has been incorporated with capital stock of $25,000. C. E. Whippe, J. F. Mead and F. P. Rogers are the incorporators.

Salem, Ore.—The Wallowa Lake Power & Development Co. has been incorporated with capital stock of $150,000. The incorporators are A. J. McInturff, B. Mayfield and C. M. Lockwood. The headquarters of the company will be at Enterprise, Ore.

Cordova, Ill.—The Cordova Light & Power Co. has been incorporated with capital stock of $25,000 to furnish light for the village of Cordova. C. C. Opdyke, J. C. Mackey and George Shumate are the incorporators.

Baltimore, Md.—Modern Electric Welding Co., 915 South Ann street, has been incorporated with a capital stock of $100,000 by John M. Hoffman, Daniel J. Lynch and Milton Roberts, to manufacture welding apparatus, etc.

New York, N. Y.—The Pollack Conduit & Electrical Supply Co. has been incorporated with a capital of $20,000 by L. Pollack, and M. Simon, 205 25th street, to manufacture electrical conduits and equipment.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods, Dynamos and Motors (32,447)—An importing firm in India desires to be placed in direct communication with manufacturers of electrical goods, motors and dynamos. References.

Electrical Goods (32,493)—A firm of engineers and merchants in India desires to import and secure agencies for all classes of electrical goods. References.

Electrical Machinery (32,345)—An American electrical and mechanical engineer in Cuba, who is manager of a machinery jobbing house, desires to secure agencies for the sale of electrical sugar mill and refinery machinery and equipment. Quotations should be given c. i. f. Havana, or f. o. b. vessel at American port. References.

GREAT LAKES TRUST COMPANY
110 SOUTH DEARBORN STREET
CHICAGO

April
Twentyseventh,
1 9 2 0.

My Dear Mr. Tupper:

The page in the Electrical Review of April 24th headed, "Good Will as a Basis of Credit", merits comment.

From the standpoint of a banker and business man I most heartily agree with Mr. Sabin's statement and and your comments thereon.

Good will is a comprehensive term in manufacturing and merchandising. It measures the extent to which buyers are convinced of the merits of the article and the reliability of the producer and the distributor. In transportation it measures appreciation by the public of responsibility-promptness and dispatch-service. In finance it measures honesty and fair dealing, conservatism, responsibility, ability, power and willingness to serve.

Advertising in its many forms is a tremendous power for good in trade, commerce and finance. Its value is not alone in good will items, but is actually measurable in the market values of merchandise, securities, service.

I do not regard good will as wholly intangible. True it cannot be exactly weighed or measured, yet it is an actual part of our American machine tools, our automobiles, our electrical goods, etc., worth far less than cost.

As a banker I believe in well balanced advertising for the customers of the bank and for the bank itself. Properly applied and used it is a substantial credit asset. Properly followed up it wears better than iron or steel.

Very sincerely yours,
HARRY H. MERRICK,
President

Mr. C. A. Tupper,
President-Treasurer,
International Trade Press, Inc.
542 Monadnock Block,
Chicago, Illinois

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Buffalo General Electric Sells $2,000,000 in Bonds.

The Buffalo General Electric Co. has issued $2,000,000 5-year 7 per cent convertible bonds, which have been purchased by Lee, Higginson & Co., Boston, Mass., and which are now being offered by the latter concern. The bonds are due April 1, 1925, and are callable at the option of the company as a whole, but not in part, on any interest payment date after 5 weeks' notice. On Oct. 1, 1922, they are callable at 103 and accrued interest; during 1923 at 102 and accrued interest; and during 1924 at 101 and accrued interest. They are convertible at the holders' option at any time after May 1, 1922, into the common capital stock of the company par for par. The proceeds of this issue of bonds will be used to add to the company's distribution system to care for its rapidly increasing business. While this new construction work has as yet yielded no revenues, the earnings for 1919 were more than 2¼ times interest charges for that year and more than 1.9 times the $792,880 interest charges on the entire present funded debt, including this issue of $2,000,000. The company has paid continuous dividends ranging from 5% to 8% a year on its outstanding capital stock since 1900. The present rate paid is 8%.

Southwestern Bell Telephone Offers Large Note Issue.

The Southwestern Bell Telephone Co., through Caldwell & Co., investment brokers, Security building, St. Louis, Mo., are offering for sale $25,000,000 5-year 7% convertible gold notes at 97½ cents, and interest yielding 7.6%. The notes are direct obligations of the company, which has only $1,257,400 outstanding underlying bonds which may not be increased. Proceeds of the $25,000,000 issue, together with proceeds from the recent sale of $4,500,000 additional common stock to the American Telephone & Telegraph Co., will be used for new construction to provide for the growth of the business and for the reduction of the company's floating debt.

Manhattan Electrical Supply Co.

The Manhattan Electrical Supply Co., Inc., New York City, for the year ended Dec. 31, 1919, reports net profits after expenses and Federal taxes of $702,910, equivalent after allowing 7% for preferred dividends to $20 a share ($100 par value) earned on the $3,000,000 common stock, as compared with $523,692 or $13.35 a share on the common stock in 1918. Income account for the year ended Dec. 31, 1919, compares as follows:

	1919.	1918.
Net sales	$6,962,988	$5,554,399
Cost of sales	5,052,055	3,950,839
Gross profit	$1,910,933	$1,603,560
Other income	14,076	12,770
Gross profit	$1,925,009	$1,616,330
Exp. and Federal taxes	1,222,099	1,092,638
Net profit	$ 702,910	$ 523,692

Republic Railway & Light Co.

Combined earnings of the Republic Railway & Light Co. and its subsidiary companies for January and the twelve months ended Jan. 31, 1920, compare with 1919 as follows:

	1920.	1919.
January gross	$ 696,408	$ 529,929
Net after taxes	157,392	113,562
Total income	169,465	139,657
Surplus after charges	51,718	27,380
Balance after preferred dividends	25,761	1,425
Twelve months' gross.	6,426,054	5,593,797
Net after taxes	1,561,473	1,417,382
Total income	1,806,321	1,526,161
Surplus after charges	432,780	247,942
Balance after preferred dividends	121,296	*63,542

*Deficit.

Cumberland County Power & Light Co.

Earnings of the Cumberland County Power & Light Company for February and the twelve months ended Feb. 29, 1920, compare with 1919 as follows:

	1920.	1919.
February gross	$ 215,376	$ 198,988
Net after taxes	19,602	55,187
Surplus after interest charges, etc.	*35,554	*1,470
Twelve months' gross.	2,828,435	3,198,977
Net after taxes	952,220	998,681
Surplus after interest charges, etc.	282,702	167,798
Balance after preferred dividends	144,792	29,798

*Deficit.

Puget Sound Traction, Light & Power Co.

Earnings of the Puget Sound Traction, Light & Power Co., now the Puget Sound Power & Light Co., for the month of January and the twelve months ended Jan. 31, 1920, are as follows:

	1920.
January gross	$ 899,488
Net after taxes	414,506
Surplus after charges	257,828
Twelve months' gross	9,534,690
Net after taxes	3,379,202
Surplus after charges	1,491,573

Chattanooga Railway & Light Co.

Earnings of the Chattanooga Railway & Light Co. for February and the 12 months ended Feb. 29, 1920, compare with 1919 as follows:

	1920.	1919.
February gross	$ 108,200	$ 81,704
Net after taxes	44,350	37,054
Surplus after interest charges	23,806	15,781
Twelve months' gross.	1,092,277	979,162
Net after taxes	380,519	378,177
Surplus after interest charges	127,761	136,393

Nashville Railway & Light Co.

Earnings of the Nashville Railway & Light Co., for February and the twelve months ended Feb. 29, 1920, compare with 1919 as follows:

	1920.	1919.
February gross	$ 284,034	$ 252,993
Net after taxes	74,643	72,514
Surplus after interest charges, etc.	34,657	32,635
Twelve months' gross.	3,290,011	2,988,074
Net after taxes	785,910	978,414
Surplus after interest charges, etc.	310,480	498,602

Dividends.

The Brooklyn Edison Co., Inc., has declared its regular quarterly dividend of $2 a share, payable June 1 to stockholders of May 21.

The Pacific Power & Light Co. has declared its regular quarterly dividend of 1¾% on the preferred stock, payable May 1 to stockholders of record April 22.

The Columbia Gas & Electric Co. has declared its regular quarterly dividend, payable May 15 to stockholders of record April 30.

The Dallas Power & Light Co. has declared its regular quarterly dividend of 1¾% on preferred stock, payable May 1 to stockholders of record April 24.

The Peerless Insulated Wire & Cable Co. has declared quarterly dividends of $2 a share each on the first and second preferred stocks, both payable May 1 to stockholders of record April 28.

The Pacific Gas & Electric Co. has declared the regular quarterly dividends of $1.50 a share on the first preferred and original preferred stocks, payable May 15 to stockholders of record April 30.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid Apr. 20.	Bid Apr. 27.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	11	10
Adirondack Electric Power of Glens Falls, preferred	6	73	71
American Gas & Electric of New York, common	10+extra	121	115
American Gas & Electric of New York, preferred	6	37½	37
American Light & Traction of New York, common	..	174	155
American Light & Traction of New York, preferred	6	88	85
American Power & Light of New York, common	4	60	58
American Power & Light of New York, preferred	6	70½	70½
American Public Utilities of Grand Rapids, common	..	5	5
American Public Utilities of Grand Rapids, preferred	7	14	12
American Telephone & Telegraph of New York	..	104	102
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip.	7	8	7
American Water Works & Elec. of New York, first preferred	..	45	45
Appalachian Power, common	..	1	1
Appalachian Power, preferred	7	15	15
Cities Service of New York, common	+extra	382	375
Cities Service of New York, preferred	6	69	68
Commonwealth Edison of Chicago	8	105	102
Comm. Power, Railway & Light of Jackson, common	..	27	20
Comm. Power, Railway & Light of Jackson, preferred	6	47	40
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	44	44
Middle West Utilities of Chicago, common	..	19	18
Middle West Utilities of Chicago, preferred	..	40	36
Northern States Power of Chicago, common	..	47	45
Northern States Power of Chicago, preferred	ex.div.7	85	85
Pacific Gas & Electric of San Francisco, common	..	50	52
Public Service of Northern Illinois, Chicago, common	7	78	83
Public Service of Northern Illinois, Chicago, preferred	6	82	79
Standard Gas & Electric of Chicago, common	..	17	17
Standard Gas & Electric of Chicago, preferred	6	39	38
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	5
United Light & Railways of Grand Rapids, common	4	24	23
United Light & Railways of Grand Rapids, preferred	6	61	60
Western Power of San Francisco, common	..	16	14
Western Union Telegraph of New York	extra	82	80
Industrials—			
Electric Storage Battery of Philadelphia, common	4	105	105
General Electric of Schenectady	8	175	175
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54	52